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THE NEXUS OF MONETARY AND EXCHANGE RATE POLICY IN THE POST-ASIAN CRISIS PERIOD: HAVE THE LESSONS BEEN LEARNED?

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1 Introduction

The openness of an economy to internationally mobile capital makes it difficult to conduct an independent monetary policy. When capital is mobile, it is difficult if not entirely impossible, for the authorities to target the money supply and the exchange rate simultaneously.

Doubts have been raised about the degree of flexibility of exchange rate systems in some Asian countries prior to the crisis. (Hernandez and Montiel, 2001, p.6, and Calvo and Reinhart, 2000) The monetary framework was anchored to the exchange rate regime, and in most cases, was managed closely to reflect movements in the US dollar. The official exchange rate regime in Thailand was fixed. Korea had a managed float although not vis-à-vis the US dollar. In Indonesia, the central bank managed money market rates to support the exchange rate peg and fluctuated within a narrow range. (Enoch et al., 2001, p.86) The Philippine peso had officially been floating since 1984, but there is evidence that it in fact was also managed. (Gochoco, 1992, Gochoco-Bautista, 2002)

This policy of essentially pegging the domestic currency became inconsistent with the targeting of monetary aggregates to control inflation when these countries liberalized their capital accounts beginning in the 1990s. Policymakers have stated that one lesson from the crisis is the need for a more flexible and market-oriented exchange rate policy to be pursued, compatible with a more independent monetary policy in an environment in which capital is mobile. Nevertheless, the tradeoffs faced by policymakers between the control of inflation and other competing goals, such as output growth, may affect their commitment to pursue correct policies.

The efficacy and wisdom of orthodox prescriptions of contractionary monetary policy, through lower domestic credit growth or higher interest rates, to help strengthen domestic currencies have come under question in light of the experience of Asian countries during the crisis (Furman and Stiglitz, 1998; Radelet and Sachs, 1998). Indeed, some contend that raising interest rates during a crisis is counterproductive as it does not reduce market pressures on the currency but merely exacerbates the contraction in output.

This study will examine the conduct and effects of monetary policy before and during the crisis in four Asian countries. The study will attempt to address the following questions:

(i) characterize exchange rate regimes before and after the Asian crisis to examine whether exchange rate regimes have become more flexible since the crisis;

(ii) how authorities responded to exchange market pressure, particularly whether orthodox measures were implemented;

(iii) whether these responses were effective in reducing such pressure on currencies; and

(iv) whether the effects of policy actions taken are invariant with respect to crisis versus non-crisis periods.

Monthly data for the period 1987.01 to 2001.07 for Korea, Thailand, Indonesia, the most severely affected countries during the crisis, and the Philippines, which was moderately affected, are used. The study is divided into the following sections: Section 2 is a literature survey of the factors that led to financial vulnerability in these countries; Section 3 discusses the responses to the crisis and examines certain stylized facts with regard to exchange rate flexibility in the pre and post-crisis period; Section 4 presents the empirical methodology; Section 5 discusses the empirical findings; and Section 6 presents the summary and conclusions.

2 Into the Crisis

There are several factors that increased the vulnerability to financial crisis of countries included in this study. One factor is structural weaknesses in financial systems and governance arising from a long history of government control of the credit allocation process. Government essentially chose sectors or specific firms to which credit was to be allocated, usually on the basis of political connections. Hence, it effectively acted as the private sector's risk partner since it could intervene to save troubled firms by allocating more credit to it. (Cho, 2002, p.109)

Debt financing by firms was encouraged since credit from the government generally involved subsidized rates. This was true in the case of Korea, with its heavily leveraged corporations or chaebols, and also in Thailand, Indonesia, and the Philippines. In the Philippines and Indonesia, for example, banks became mere conduits for the proceeds of loans usually sourced from cheap rediscounting windows at the central bank.

With the liberalization of the capital account in the 1990s, firms used to debt finance could now tap foreign capital markets. Since domestic interest rates were typically maintained above foreign interest rates in order to reduce pressure on the domestic currency and maintain a stable exchange rate, it seemed cheaper to borrow from abroad.

Financial and capital account liberalization was seen to be a conscious decision on the part of domestic authorities. This was most evident in the case of the so-

called Bangkok International Banking Facilities (BIBF) in March 1993 aimed at establishing Bangkok as an international financial center in the region. In hindsight, this appears to have been a major policy blunder. (Nidhiprabha, 2002, p.53) The BIBFs were to borrow funds from abroad and lend only in foreign currencies either to domestic or foreign borrowers. Lending to local Thai firms in an 'out-in' manner was seen as reducing the cost of borrowing by these firms as domestic interest rates were higher than foreign interest rates. Not surprisingly, the 'out-in' lending was twice as large as the so-called 'out-out' lending. (Nidhiprabha, 2002, p.56) The lifting of interest rate ceilings removed the ability of government to act as a risk partner of the private sector as its monopoly role in the allocation of credit weakened or disappeared altogether. It likewise made it difficult for the Bank of Thailand to control massive capital inflows that practically eliminated the differential between domestic and foreign interest rates.

Government policy in the Philippines likewise encouraged direct and indirect exporters to borrow dollar loans from foreign currency deposit units to reduce interest costs. The average Treasury bill rate in 1996 was 12.4 percent, a level higher than those in the rest of ASEAN except Indonesia for assets of the same maturity, and much higher than that on long-term US bonds. As the average peso-dollar rate barely changed from 26.41 to 26.34 between 1994 and 1996, the result was an explosion in foreign borrowing, from US$ 604M in 1994 to US$ 5.031B in 1996. Domestic banks intermediated much of these as their net foreign loans and discounts increased from 53 percent in 1995 to 103.1 percent in 1996. (Gochoco-Bautista, 2002, pp.18-19)

A second factor that increased the vulnerability of currencies to speculative attack was the relative stability of exchange rates, with the domestic currency usually maintained at an overvalued level. The serious misalignment of the Thai baht created pressures on the baht beginning in late 1996 and led to an unsustainable current account deficit. This combined with rising short-term foreign debt, a deteriorating fiscal balance, and difficulties in the financial sector by early 1997. (Lane et al., 1999, p.2) The Korean won remained overvalued and inflexible for most of the 1990s until the crisis because capital inflows following capital account liberalization appreciated the won. There was also increasing pressure from the US government to appreciate the won in the face of yen depreciation. (Cho, 2002, p.133) Indonesia replaced the US dollar as the external anchor in 1978 with an undisclosed basket of major currencies and moved to a managed float. The authorities targeted a rate of depreciation of three to five percent per year around a central band, widening the band several times until it reached 6 percent in September 1996. (Nasution, 2002, p.96) The nominal peso US dollar exchange rate was very stable but the peso experienced real appreciation before the 1997 crisis struck.

The stability of exchange rates gave rise to a 'one-way bet', and engendered large scale, unhedged short-term foreign currency borrowing by the private sector and the creation of asset price bubbles when the capital account became more open. There were hardly any perceptions of foreign currency risk and currency mismatches. Many firms became highly leveraged using foreign debt. However, government could no longer simply 'print money' to assist domestic firms in trouble nor could they effectively use moral suasion over foreign lenders to roll over debt in hard times.

The viability of domestic banking systems became imperiled as the corporate sector overborrowed and experienced difficulties. Foreign creditors refused to roll over their short-term credit to Korean commercial banks and merchant banking companies. (Cho, 2002, p. 109) Non-performing loans of the banking system rapidly increased as six of the largest thirty chaebols go bankrupt between January and October 1997.

The corporate sector in the Philippines showed signs of overborrowing and declining productivity of investment beginning in 1993, the year after the foreign exchange market was liberalized. Corporations suffering from weak internal generation of funds shifted to incremental borrowing. (Saldana, 1999, p.1) With the corporate sector's weak performance, the ROE of the banking system dropped dramatically from 16.34 percent in 1996 to 12.42 percent in 1997 and then to 6.6 percent in 1998. (Guinigundo, 1999, p.4)

A third factor was the absence of a correspondingly stronger financial regulatory and supervisory system in financial markets following capital account opening. In economies generally characterized by asymmetric information, capital inflows lead domestic market participants to take on excessive risk.

The attention given to the supervisory role of government in Korea was inadequate despite the acceleration of the pace of financial liberalization after 1993. (Cho, 2002, p. 129) Korea liberalized foreign borrowing by banks, but did not impose any significant restriction on their short-term borrowings in contrast to those that remained on long-term borrowings. This led to a dramatic increase in short-term foreign debt when the economy was experiencing a boom in 1994. (Cho, 2002, p.121) When the Korean economy entered a recession in 1996, the debt-service capacity of all firms deteriorated rapidly, making it vulnerable to a financial crisis.

In Thailand, the regulation on the maximum net oversold position of banks became less effective. It allowed Thailand's short-term external debt to increase as BIBF lending in foreign currencies were treated as foreign assets of the banking system. By 1995, the ratio of short-term to total debt of BIBFs rose to 86 percent from 58 percent in 1992. (Nidhiprabha, 2002, p.58)

Prudential regulations in line with BIS standards were not effectively implemented in Indonesia because of structural weaknesses in the legal and accounting systems. (Nasution, 2002, p.84) Following economy wide reform, including banking reform in 1988, the private sector became heavily indebted, holding over 60 percent of total external debt of which nearly 90 percent was short-term. By March 1997, Indonesia's external debt had tripled from its level in 1989 or 215 percent of exports in 1997. (Nasution, 2002, p.75). Rising inflation and a widening current account deficit accompanied economic growth. As in Korea, a crisis ensued when foreign lenders refused to roll over the country's large short-term debt.

In the Philippines, the strengthening of prudential norms, such as strengthening bank capitalization requirements, began in earnest only in 1994 while the foreign exchange market had been liberalized beginning in 1992.

3 Responses to the Crisis

The IMF and other multilateral financial institutions provided large official financing packages to Korea, Indonesia, and Thailand. The IMF programs assigned a greater task to monetary policy than to fiscal policy as conventional fiscal imbalances were not a major part of the problem. Structural policies aimed at reforming the financial and corporate sectors were also important elements in the programs with Korea, Indonesia, and Thailand.

The Philippines was in a slightly different situation as it already had an Extended Fund Facility (EFF) Program with the IMF at the time of the crisis. The Philippines experienced a milder recession than its neighbors did but also did not have as large capital inflows prior to the crisis. In part, this was because it returned to voluntary credit markets only in 1991 following the moratorium on external debt service payments it imposed beginning in 1984.

3.1 Monetary Policy Responses to the Crisis

The focus of monetary policy was currency stability and the prevention of spiraling depreciation and inflation while ensuring that monetary tightening would not be excessive as to severely weaken real economic activity. (Lane et al., 1999, p.5) There would be some leaning-against-the wind in the foreign exchange market, but not a return to pegging or targeting a particular level of the exchange rate. Credit and interest rate policies rather than direct foreign exchange intervention was the monetary policy tool used to stabilize currencies. The nominal interest rate was adopted as the de facto gauge of the stance and instrument of monetary policy tightening, and together with the exchange rate, guided day-to-day policy. (Ghosh and Phillips, 1999, p. 36)

Difficulties in controlling the money supply prior to the crisis exacerbated depreciation pressures on the currencies. Broad money in Indonesia continued to grow in real and nominal terms in the second half of 1997 and early 1998. Indonesian authorities were unable to sterilize the effects of foreign exchange market intervention as the central bank injected liquidity into the banking system to prevent its collapse. Sterilization was made difficult by the absence of functioning domestic money markets and the lack of market-determined interest rates.

The IMF package for Korea aimed to reduce the current account deficit, build up foreign exchange reserves, and contain inflation through both the tightening of monetary policy and some fiscal measures. As in Indonesia, however, broad money continued to grow in real and nominal terms in the second half of 1997 and early 1998.

Nominal money in Thailand declined slightly in late 1997 and declined in real terms from mid-1997 to mid-1998. The key elements of the IMF policy package for Thailand included fiscal adjustment measures to reduce the deficit in the current account and bring about a fiscal surplus, control domestic credit with indicative ranges for interest rates, allow greater flexibility in the baht with interventions limited to smoothing. (Lane et al., 1999, p.2) Fiscal policy was used to increase public savings and mitigate the increase in the monetary base. However, this reduced the ability of the central bank to undertake sterilization operations since it simultaneously reduced the amount of government securities held by the central bank.

Monetary policy in the Philippines was tightened from the time the crisis struck in July 1997 to the end of 1998, but as the peso stabilized, monetary policy was substantially eased in early 1999.

Both the Thai and Korean programs used ceilings on net domestic assets (NDA) of the central bank and floors on net international reserves as performance criteria. In contrast, there was a ceiling on base money rather than NDA in Indonesia in order to allow for some "judicious" intervention in the foreign exchange market. (Ghosh and Phillips, 1999, p. 36) In a setting with severe foreign exchange market pressures, however, a ceiling on base money would allow most of the monetary impact of foreign exchange losses to be sterilized faster than programmed credit expansion, aggravating depreciation pressures.

Monetary policy in the Philippines has likewise been anchored, in principle, to base money targets since 1984. However, both the pursuit of multiple objectives, and shifts in money demand have resulted in the base money targets rarely being met. Hence, inflation has been high and variable relative to other countries in the region. (Debelle and Lim, 1998, p. 6) In the 1994 Extended Fund Facility Program

with the IMF, an inflation feedback rule was incorporated into the program. This allowed base money targets to be adjusted upward by the amount that international reserves exceeded expected levels as long as inflation stayed within the target range. (Debelle and Lim, 1998, p.6) Changes in the overnight and short-term reverse repurchase rates (RRPs) are used by the central bank to adjust the stance of monetary policy. Changes in liquidity reserve requirements are sometimes used by the central bank to reduce excess liquidity in the system.

3.2 Exchange Rate Policy since the Crisis

In the wake of the crisis and in consultation with the IMF, the authorities in these countries stated that they would allow exchange rates to be more flexible. Pegging became infeasible as foreign reserves and available financing to defend against short-term speculative pressures on the currency were insufficient, credibility problems associated with pegging had been experienced previously, and it was recognized that domestic currencies had overshot their long-run equilibrium positions during the crisis. It would have been inappropriate to peg at a much depreciated level of the currency. However, the removal of the exchange rate anchor and a depleted stock of international reserves allowed much room for discretion by policymakers, in consultation with IMF staff, through "informal understandings about exchange rate and interest rate policies." (Boorman et al., 2000, p.8)

Some have argued that policymakers failed to raise interest rates sufficiently to counteract expectations of depreciation before currencies were made to float. (Boorman et al., 2000, p. 32) Interest rates in Korea were reluctantly and abruptly raised in late December 1997 in the midst of a funding crisis, while in Indonesia, interest rates were rolled back prematurely to pre-crisis levels in November 1997. Similarly, interest rates were lowered in Thailand in early August 1997 and in mid September 1997. In the Philippines, interbank rates increased from about 15 percent to 40-60 percent right before the flotation of the baht in July 1997.

The use of an active interest rate policy to control the growth of domestic liquidity and prevent further currency depreciation necessitated a reform of the institutional structure in Indonesia. First, the central bank needed to contain the expansion of liquidity growth as a result of the replenishment of deposit withdrawals from the banking sector. Second, the central bank needed to establish a market-based interest rate to provide a clear signal to the market regarding the stance of monetary policy. The central bank closed several refinance facilities, required state-owned enterprises to hold central bank bills or SBIs, and withdrew deposits from specific banks.

These had the effect of raising interest rates to about 100 percent in August 1997, but real interest rates remained negative until a year later with high interest rates

reflecting lack of confidence. (Enoch et al., 2001, p. 86) Monetary and credit aggregates continued to grow until mid-1998 when real interest rates became positive and inflation moderated. The central bank introduced 'rupiah interventions' in January 1998 by absorbing excess liquidity from the market at the going market interest rates. These raised interbank rates from 30 percent in January 1998 to over 40 percent in mid-February but not bank deposit and lending rates as these were still tied to the SBI.

Philippine monetary authorities had been intervening in the foreign exchange market prior to the crisis in a unique way. (Boorman et al., 2000, p.19) Nondeliverable Forward Interventions (NDFs) was an operation in which the central bank invited certain foreign banks to borrow abroad and sell the proceeds in the local foreign exchange market with forward contracts issued by the central bank to hedge the banks' against risk. Foreign currency is not actually delivered at maturity. Instead, the difference between the forward and spot rate at maturity is settled in local currency. While this manner of intervention has the advantage of being able to generate dollar inflows without using up official international reserves, it is indirect and very non-transparent.

4 Empirical Methodology

4.1 Measuring Exchange Rate Volatility vis-à-vis other variables

To describe certain stylized facts relating to exchange rate volatility, interest rate volatility, and the volatility of international reserves, the conditional variances of these variables are estimated using the univariate GARCH methodology. The method has been used extensively in volatility measurement because unlike OLS which assumes a constant unconditional variance, this technique permits the modeling of a time varying conditional variance. (See Appendix A for a brief discussion of the method; Appendix B gives the data sources and description.) For all volatility estimates, the study makes use of a GARCH (1,1) specification.

Figures 1, 2, and 3 show how variable the rate of currency depreciation, changes in the interest rate, and the growth in international reserves have been over time. As in Gochoco (1992), it may be possible to decipher if monetary authorities try to smoothen exchange rate movements via high interest rates and/or direct foreign exchange market intervention. If monetary authorities try to lean-against-the-wind and are successful in doing so, for example, we would observe very stable exchange rates accompanied by highly variable interest rates and/or international reserve movements, in response to currency pressures.

Conditional Variance of the Rate of Currency Depreciation

The graphs of the conditional variances of the rate of currency depreciation show that in all countries, there is slightly greater exchange rate volatility since the start of the crisis in July 1997, reaching peaks in early 1998, compared to the pre-crisis period. The orders of magnitude show that the Indonesian rupiah exhibits the greatest volatility, similar to that of the Thai baht. The Philippine peso has the smallest orders of magnitude and exhibits the least volatility among the four currencies. The Korean won is an intermediate case in terms of exchange rate volatility, in between the Indonesian rupiah and Thai baht on the one hand, and the Philippine peso on the other.

Conditional Variance of the Change in Interest Rates

In Korea and Thailand, interest rate volatility increased in 1998 and early 1999, before starting to decline. In the Philippines, interest rates were very stable except for a slight increase in July 1997, and then in late 2000 when interest rate volatility also increased.

Indonesia was different in that interest rate volatility peaked right before rather than after the crisis struck before declining in late 1997. In the 1992-1996 period, interest rate volatility rather than greater volatility in international reserves seems to be associated with a stable rupiah. Interest rate volatility has been increasing slightly since mid 2000.

Comparing the graphs of the conditional variances of exchange rates and interest rates, it appears that as the conditional variance of interest rates dropped dramatically starting in mid-1997 in Indonesia, the conditional variance of the exchange rate increased, peaking in early 1998. Likewise, as interest rate volatility begins to increase in 2000 and 2001, rupiah volatility fell to very low levels.

In Korea, both interest rate and exchange rate volatility peaked in early 1998. Interest rate volatility was higher in 1998 and 1999 than in the pre-crisis period, and the exchange rate stabilized beginning in late 1998. Beginning in 2000, however, currency volatility remained low even though interest rate volatility was lower than in the crisis period, and is similar to interest rate volatility in the pre-crisis period.

In the Philippines, interest rate volatility was seemingly unrelated to exchange rate volatility during the crisis period, except for the slight increase in interest rate volatility around July 1997 following the collapse of the baht, which seems to coincide with a reduction in the volatility of the peso. As peso volatility increased

around November 2000, interest rate volatility increased in December 2000. This is followed by the decline in the volatility of the peso thereafter.

In Thailand, interest rate volatility peaked in February 1998 while the volatility of the baht fell in March. Thereafter, interest rate volatility stabilized and the Thai baht exhibited greater volatility compared to the pre-crisis period.

In general, interest rate volatility and exchange rate volatility do seem to be inversely related as expected. Nevertheless, both have declined in the post-crisis period relative to the crisis period. The exception is Indonesia since 2000, where interest rate volatility has been rising. The general findings are consistent with allowing greater currency flexibility despite pressures on the currencies but would also be consistent with a scenario in which there are fewer pressures on currencies in the post crisis period and, therefore, less need to counteract such using monetary tools.

Conditional Variance of Growth in International Reserves

It is evident from the graph of the levels of foreign exchange reserves in Figure 4 that all the four countries have been accumulating international reserves since the early 1990s when foreign exchange markets were liberalized. This pattern became more dramatic since 1998 in the immediate aftermath of the Asian crisis. International reserve levels are at all-time highs in all countries except Thailand since the crisis. Korea's levels of international reserves show the steepest ascent from the beginning of 1998, when usable reserves fell dramatically.

Looking at the conditional variance of the growth in Indonesia's international reserves in Figure 3, one notes that there were increases in the volatility of reserves in 1998 during the crisis, and also in late 2000 and early 2001. It appears that the increasing volatility of international reserves in these periods corresponds to periods in which currency volatility was declining. Both the increases in international reserve volatility and interest rate volatility since the crisis are inconsistent with a more flexible exchange rate regime.

The volatility of the growth in international reserves in Korea increased in 1998, when usable levels fell dramatically as attempts were made to prevent greater won depreciation. Since then, however, the volatility of international reserves has fallen dramatically, to levels similar to the immediate pre-crisis period, and levels lower than those in the 1980s. Despite the lower volatility of international reserves since the crisis, currency volatility has also remained low. The very low volatility of international reserves in the post-crisis period would be consistent with fewer attempts to manage the exchange rate and allow greater flexibility. Nevertheless, this greater flexibility may have been allowed if there were fewer pressures on the currency in the post-crisis period.

In Thailand as well, the post-crisis volatility of growth in international reserves has declined dramatically and is at levels similar to those in the immediate pre-crisis period. The only dramatic increase in international reserve volatility occurred when the crisis struck in mid-1997 to the end of the year, when foreign reserves were depleted in a futile attempt to defend the baht.

In the Philippines, the volatility of growth in international reserves barely increased during the crisis in mid-1997 to 1998, and there is no discernible change in its pattern from the immediate pre-crisis period, but is much lower than its volatility in the 1980s and early 1990s. This might be misleading, however, in view of the use during the crisis of the Nondeliverable Forward Facility described earlier. It would have been possible to defend the currency without international reserve volatility increasing since official international reserves were not being used and the settlement of the difference between the forward rate and spot exchange rate at maturity was in pesos.

In terms of the conditional variances of international reserve growth, therefore, the general patterns exhibited by all the countries except Indonesia would be consistent with allowing greater flexibility of the exchange rate in the post-crisis period either because authorities chose not to intervene directly or because with fewer pressures on currencies, there was less reason to do so.

The ratio of volatility of currency depreciation to interest rate volatility

A more convenient way to see the relationship between interest rate volatility and exchange rate volatility is to calculate the ratio of the conditional variance of the exchange rate to that of interest rate changes. A graph of this is shown in Figure 5. If the exchange rate regime in place after the crisis is more flexible than that prior to the crisis, one would expect that this ratio to be larger in the post-crisis period (Hernandez and Montiel, 2001).

This is generally true for all countries and is very evident in the cases of Thailand and Korea. This finding is consistent with the earlier one of much lower interest rate volatility in the post-crisis period. In the case of the Philippines, while it is true that there is more variability in this ratio since 1999 compared to the late 1980s, it is unclear whether the post-crisis variability pattern is any different from that in the early 1990s prior to the crisis. The exception is Indonesia. In Indonesia, it seems that from the mid-2000, this ratio is close to zero again, consistent with the earlier finding of an inverse relationship between interest rate volatility, which increased in 2000, and that of the rupiah.

The ratio of exchange rate volatility to international reserve volatility

The ratio of the conditional variance of the exchange rate to that of international reserves was likewise calculated. The graphs are shown in Figure 6. Given greater exchange rate flexibility in the post-crisis period, we would expect to find a larger ratio, indicating that direct intervention in the foreign exchange market is not being used to defend the currency.

This is the case for Korea, Thailand, and the Philippines. It is consistent with the earlier separate findings comparing movements in the conditional variance of the exchange rate and that of international reserves. Indeed, in the cases of Korea and the Philippines, the peaks in this ratio are larger than those exhibited during the crisis period.

In contrast, the ratio for Indonesia shows that beginning in late 2000, exchange rate volatility was more than offset by international reserve volatility such that the ratio of these two is very small. It is consistent with our earlier finding that the increase in the volatility of international reserves beginning in late 2000 coincided with relative stability of the rupiah. Again, it appears that Indonesia is an exception. In general, exchange rate regimes have become more flexible and direct intervention in the foreign exchange market appears not to have been extensively used to stabilize the exchange rate.

4.2 VAR tests to examine the conduct and effects of monetary policy

The rationale for a policy that prescribes contractionary monetary policy to reduce exchange market pressure (EMP) can be found in Girton and Roper (1977). They use a simple monetary model to derive a definition of EMP. Assuming that Purchasing Power Parity holds and that world inflation is zero, EMP can be measured as the sum of currency depreciation and reserve outflows, and is equal to the difference between the growth rates of the domestic component of the monetary base and money demand. This measure captures the flow excess supply of money in a managed exchange rate regime, reflected in both exchange rate and reserve movements. For a given growth rate of money demand, therefore, contractionary monetary policy can be expected to raise domestic interest rates and the interest differential in favor of domestic assets. This would encourage capital inflows or reduce outflows, and thus reduce EMP.

Following Tanner (1999, 2001, 2002), a VAR methodology is used and focuses on exchange market pressure (EMP). Tests are conducted to see whether contractionary monetary policy helps reduce EMP. Since most countries did not pursue either a strictly fixed or a pure floating exchange rate regime, it would be misleading to focus only on exchange rate changes without considering changes in international reserves as well when authorities intervene in foreign exchange markets. Tanner finds that a reduction in domestic credit growth helps reduce EMP for a number of countries by increasing the value of a country's currency

and/or its stock of foreign reserves. He also finds that the response of EMP to interest rate shocks is weaker than its response to changes in domestic credit growth.

The VAR system is the following:

$$X_t = a_0 + a_1 X_{t-1} + \ldots + a_p X_{t-p} + v_t$$

where X_t = {δ, EMP, PHI) is a vector of variables; $a_1 \ldots a_p$ are coefficient matrices and $v_t = (v_\delta, v_{EMP}, v_{PHI})$ is a vector of error terms. δ is the change in domestic credit divided by lagged base money, EMP is exchange market pressure or the sum of currency depreciation and reserve outflows (scaled by base money), and PHI is the interest rate differential between the domestic interest rate and the 3-month US Treasury bill rate. In the estimation, since PHI in non-stationary, its first difference of PHI, namely, ΔPHI, is used.

Monthly data for the four countries over the period 1987.01 to 2001.07 are used. These are divided into two sub-periods, namely, a pre-crisis period from 1987.01 to 1997.06, and a crisis and post-crisis period from 1997.07 to 2001.07. The sample is split to determine whether the effects of monetary policy are similar in crisis and non-crisis periods. The model is designed to answer several questions of interest.

The first question is whether monetary policy affects EMP in the manner presumed by traditional theory. Specifically, we examine whether contractionary monetary policy reduces EMP. The stance of monetary policy can be measured by changes in domestic credit as a proportion of the monetary base since this is the portion of the monetary base controlled by monetary authorities for policy purposes. While interest rates are usually used to gauge the stance of monetary policy, as they are often set by the authorities to control the growth of domestic credit, they also have market-determined components, such as those that reflect expected exchange rate depreciation and risk premia. As a compromise, both the change in domestic credit as a proportion of the monetary base, and the differential between the domestic and US Treasury bill rates are used. To address the first question, the response of EMP to innovations in both domestic credit growth and the interest rate differential, reflected in the impulse response functions (IRFs), are examined.

A second question to be addressed is whether the stance of monetary policy itself is a function of EMP. In other words, do the authorities tighten monetary policy in response to increases in EMP or do they sterilize, such that when there are large capital outflows, domestic credit is increased? To answer this question, the effects of lagged innovations in EMP on domestic credit growth are examined. Also, do authorities react by trying to raise interest rates in the face of EMP? This

is a little more difficult to answer since domestic interest rates may increase due to a higher risk premium and fears of default when EMP increases, rather than because of any conscious efforts on the part of authorities to raise domestic interest rates.

A third question to be addressed is whether high domestic interest rates, or an increase in the interest rate differential in favor of the domestic currency, reduces EMP. Traditional theory posits that raising domestic interest rates reduces EMP. Others have proposed a revisionist theory in which higher domestic interest rates occur in conjunction with higher EMP because fears of greater risk and currency depreciation. There would therefore be a perverse effect, in which raising domestic interest rates or the differential in favor of domestic assets increases rather than decreases EMP.

5. Empirical Results

Table 1 shows the Phillips Perron unit root tests of the variables used in the VARs. The unit root hypothesis is rejected for variables δ and EMP, implying stationarity. It cannot however be rejected for the PHI variable. The first difference (D(PHI)), which as shown by the test is stationary, is used instead of PHI in the VAR estimates. Table 2 reports the optimal lag lengths used in the VARs. Table 3 shows the results of bivariate Granger tests using a lag length of 4. Figures 7a-d to 8a-d show the impulse response functions (IRFs) for the two sub-periods, namely, a first pre-crisis one from 1987.01-1997.06 and a second crisis and post-crisis one from 1997.07-2001.07. The results are as follows:

5.1 Effects of δ on EMP: Does a contraction in credit reduce EMP?

In the case of the first, pre-crisis sub-period, the IRF results show a positive effect of δ on EMP for all countries. These findings are supportive of traditional theory: an expansionary shock to monetary policy, as defined, either reduces international reserves, causes the domestic currency to depreciate, or some combination thereof. However, no Granger causality is found from δ to EMP except for Korea.

For the second sub-period, the crisis and post-crisis one, δ Granger causes EMP in all countries. Only the IRF for the Philippines appears to be positive while lagged effects are insignificant. For the other three countries, the IRFs are very erratic, with the lagged effects of δ on EMP turning negative beyond the contemporaneous effect and, therefore, less supportive of traditional theory.[i]

The magnitude of the impulse responses for Indonesia and Korea are bigger and significantly negative in the second sub-period than the first. These findings seem to imply that while domestic credit creation as a monetary tool became

stronger during the crisis period for these two countries, it did not work in the way presumed by traditional theory. The proposition that contractionary monetary policy works to reduce EMP is less tenable in the crisis and post-crisis period. It implies, therefore, that IMF prescriptions to tighten money in an effort to prevent further currency depreciation would not have unambiguously done so during the crisis and its immediate aftermath.

The magnitude of the contemporaneous impulse response for the Philippines and Thailand are more similar than those for Indonesia and Korea between the two sub-periods. Except for the Philippines, the impulse responses during the crisis period were significant whereas in the pre-crisis period, it was generally the case that only contemporaneous impulse responses were significant. That lagged effects of domestic credit creation on EMP tended to be insignificant in the pre-crisis period and also worked in the manner presumed by traditional theory, but not during the crisis and post-crisis period, seems to suggest that money works with fewer lags and predictable effects in non-crisis periods. In crisis periods, the difficulty of reducing monetary growth given other concerns, such as bailing out failing banks or ensuring that the real economy is spared from further harm, may result in confusing signals as to the stance of monetary policy, and lead to a longer, protracted effect on EMP.

5.2 Effects of EMP on δ: How do monetary authorities respond to EMP?

The Granger causality results for the first pre-crisis sub-period show that EMP Granger causes δ. The IRFs show that in the response of domestic credit creation to EMP, only lagged effects were significant in both periods. The positive IRFs show that lagged sterilization took place. Monetary authorities sterilized reserve outflows and responded to increased EMP by providing additional liquidity to the banking system rather than contracting the money supply. In other words, under non-crisis conditions, the natural inclination of countries in the face of EMP is to increase rather than contract money. Monetary authorities tend to sterilize reserve outflows and provide additional liquidity to the banking system.[ii]

In the crisis and post-crisis period, the Granger causality tests results show that EMP no longer causes δ in contrast to the earlier results. This supports the notion that monetary authorities reacted less, in terms of domestic credit creation, to EMP during the second period. The IRFs for all countries show more negative results of EMP on δ, with very mixed results for Thailand. This means that for these countries, sterilization of international reserve outflows was generally not resorted to during crisis periods. It seems, therefore, that monetary authorities in all four countries tried harder to keep money tight in the face of EMP, consistent with IMF prescriptions, in an attempt to reduce, or at least, nor worsen EMP although, from hindsight, without clear success in all cases.

5.3 Effects of ΔPHI on EMP: Do high interest rates or an increase in the interest rate differential in favor of the domestic country reduce EMP?

In the first sub-period, ΔPHI causes EMP. Indonesia's and Thailand's IRFs show a mostly lagged significant negative result, consistent with traditional theory. The contemporaneous and most of the lagged responses of EMP to shocks in the interest rate differential were insignificant in both periods. The insignificant responses imply that interest rates, as policy instruments, do not affect EMP.

In the second sub-period covering the crisis and post-crisis period, ΔPHI never causes EMP, according to the Granger causality results. This seems to imply that during a crisis and thereafter, it is not possible to use high interest rates to reduce EMP.

Thailand had a generally significant positive impulse response in the second period. Indonesia had two lagged significantly positive responses in the second period as well, while Korea had a slightly positive lagged response in the same period also. The positive response of EMP to ΔPHI is contra traditional theory. It leaves open the possibility of a perverse effect in which raising interest rates raise EMP by raising the risk premium or the risk of default. The finding of largely lagged positive responses of EMP to ΔPHI in this sub-period results also brings out the inherent difficulty of gauging the stance of monetary policy using interest rates.

5.4 Effects of EMP on ΔPHI

In the first sub-period, EMP Granger causes ΔPHI in all countries except Korea. The effect of a shock to EMP on ΔPHI is largely positive. The Philippines and Thailand had significant positive lagged responses in the pre-crisis period. This means that when EMP rises, domestic monetary authorities attempt to raise the interest rate differential in order to reduce EMP. However, increases in the interest rate differential may also occur in conjunction with increasing EMP because of fears of currency depreciation and a higher risk premium. In the second sub-period, EMP Granger causes ΔPHI in all countries except Indonesia. Korea and Thailand had significant positive lagged responses in the crisis and post-crisis period.[iii]

In general, therefore, when EMP rises, the interest rate differential also increases, either because authorities attempt to raise the interest rate differential deliberately or because interest rates rise because of fears of depreciation and higher risk premiums.

Taken with the immediately preceding results, one may ask why monetary authorities used interest rates to respond to EMP when the interest rate tool is

ineffective. One reason may be that if interest rates are used as the gauge of the stance of monetary policy, and monetary authorities subscribe to traditional theory, their expectation would have been that higher interest rates would reduce EMP. However, this would seem to be belied by their reluctance to raise interest rates during the crisis. A more likely explanation is that they failed to realize that as noisy an indicator of monetary stance interest rates are, during a crisis, the noise is even greater and market factors, rather than policy moves by the authorities, take on greater importance and move interest rates. Due to data limitations, the interest rates used in this study are market rates rather than explicit policy rates of central banks.

6. Summary and Conclusions

This study examined whether certain lessons from the Asian crisis have been learned. Specifically, given that capital accounts have been liberalized, the exchange rate regime in place needs to be more flexible in order to allow for an independent monetary policy to control inflation. The study examined the response of monetary authorities to exchange market pressure, whether such responses are successful in reducing exchange market pressure, and whether the results are invariant as to whether they are applied in crisis versus non-crisis periods.

In general, most countries have adopted more flexible exchange rate regimes since the crisis, consistent with more open capital accounts. The study finds that the conditional variances of currency depreciation in Indonesia, Korea, Thailand, and the Philippines have increased over time, especially since the crisis. Interest rate volatility and the volatility of the growth in international reserves have also declined in Korea, Thailand, and the Philippines since the crisis. Together with greater volatility in the exchange rate, this would be compatible, in principle, with fewer attempts to peg the exchange rate via high interest rates or foreign exchange market intervention and therefore, with a more flexible exchange rate regime in the post-crisis period. However, it is also compatible with a scenario in which because of fewer pressures on currencies, there was no reason to use monetary tools to lean-against-the-wind. The exception to this is Indonesia as both interest rate volatility and international reserve volatility have been increasing in the recent period.

The ratios of the conditional variance of currency depreciation to the change in the interest rate and that to the rate of growth in international reserves were also examined. If indeed countries have refrained from using either higher domestic interest rates or direct foreign exchange market intervention to stem depreciation pressures, we would notice larger values for these ratios compared to the past. This appears to be the case for Korea, Thailand, and the Philippines since the

crisis. The exception is Indonesia, in which both ratios are almost zero since about 2000. Exchange rate volatility is highest in Indonesia relative to the other countries. It thus appears that these attempts at slowing down the depreciation of the rupiah through the use of high interest rates or direct foreign exchange market intervention have not been very successful.

There are differences in the effects of policy actions taken to reduce exchange market pressure (EMP) and the effects of these actions during non-crisis and crisis periods. In terms of whether monetary contraction reduces EMP as traditional theory posits, the study finds that there is a different effect during crisis and post-crisis periods compared to non-crisis periods. During crisis periods, it is not generally the case that monetary contraction reduces EMP. Thus, the efficacy of the usual IMF prescriptions based on traditional theory to contract money during a crisis to reduce depreciation pressures and stabilize the currency is less clear.

Despite this, however, it appears that in general, authorities react to EMP in crisis periods by not attempting to sterilize reserve outflows and keeping money tight in an attempt to reduce, or not worsen EMP, also in line with IMF policies. This is in contrast to non-crisis periods in which authorities react to EMP by engaging in lagged sterilization, increasing domestic liquidity to the banking system.

While many, the IMF included, use domestic interest rates as a gauge of whether money is tight or not, this seems to be a difficult proposition to defend especially during crisis periods. During crisis periods, there is no Granger causality between interest rate changes and EMP, meaning that in principle, raising interest rates is ineffective in stemming EMP. Despite this, authorities used interest rates to try and quell EMP, evidently except in the case of Indonesia during the crisis period. Perhaps, authorities did so because they failed to realize that as noisy an indicator of monetary stance interest rates are, during a crisis, the noise is even greater and market factors, rather than policy moves by the authorities, take on greater importance and move interest rates.

In general, therefore, while all countries studied except Indonesia seem to have adopted a less interventionist exchange rate policy, and thus, a framework more consistent with more open capital accounts, the appropriate response to EMP is not invariant with respect to crisis and non-crisis periods. Unfortunately, it also appears that traditional methods have less clear effects during crisis periods. Furthermore, it appears to be a mistake to gauge the stance of monetary policy using domestic interest rates, particularly during a crisis, as these are affected by perceptions of increased risk and greater depreciation. This may be the reason why, while the VAR results imply that Indonesian authorities did not use interest rates to respond to EMP in the crisis period, the results of the GARCH show that the conditional variance of interest rates increasing in the post-crisis

period. It seems to indicate that while the authorities may not be deliberately raising interest rates in response to EMP, interest rates are changing because of other market-driven forces. Why the exchange rate stabilized in Indonesia given non-policy induced volatility in interest rates remains a puzzle.

Extensions of the study include an alternative measure of EMP and a more deliberate method of measuring the stance the stance of monetary policy.

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Appendix A
THE GARCH MODEL

The conditional variance of some of the variables in this study is used as the volatility indicator. It is measured using the popular univariate GARCH methodology. This method proposed Bollerslev includes as a special case, the original ARCH formulation of Engle (1982). Assume as in this study, that the variable of interest follows a first order autoregressive scheme of the form:

(1) $$x_t = \phi_0 + \phi_1 x_{t-1} + e_t$$

where x_t can be the depreciation rate of the domestic currency or the percentage rate of change in the interest rate. These are computed as 100 times the first difference of the logarithm of the variable in levels: $x_t = 100 \cdot (\ln P_t - \ln P_{t-1})$.

In univariate GARCH modeling, the error process of equation (1) is specified as:

(2a) $$e_t = \sigma_t v_t \quad ; \quad v_t \sim iid(0,1)$$

and the conditional variance is given by

(2b) $$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i e_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$$

This specification of the conditional variance allows for autoregressive and moving average components. The model above is termed a GARCH(p, q) model. Note that if $q = 0$, this reduces to Engles ARCH(p) model. Several extensions of the model have been done. For a discussion of these extensions, see Hamilton (1994) or Verbeek (2000). The GARCH parameters are most conveniently estimated using maximum likelihood techniques. The estimates in this study make use of Eviews 4.1.

Appendix B
Data Sources and Description
Monthly, 1987:01 to 2001:07

	Indonesia	Korea	Philippines	Thailand
Reserve Money	Central Bank Website*	IFS, several issues	BSP	Central Bank Website**
Net Foreign Asset	Central Bank Website*	IFS, several issues	BSP	Central Bank Website**
Net Domestic Assets	Central Bank Website*	IFS, several issues	BSP	Central Bank Website**
Exchange Rate	Central Bank Website*	IFS, several issues	BSP	Central Bank Website**
Interest Rate	Lending Rate IFS, several issues	CP 91 day IFS, several issues	91 day t-bill rate BSP	Money mkt rate IFS, several issues
International Reserves	IFS, several issues	IFS, several issues	IFS, several issues	IFS, several issues

*http://www.bi.go.id/bank_indonesia_english/main/statistics/

**http://www.bot.or.th/bothomepage/databank/EconData/Econ&Finance/index1e.htm

Table 1
Phillips Perron Test
(numbers are p-values)

	Exogenous	Delta	EMP	PHI	D(PHI)
Indonesia	Constant	0.00	0.00	0.22	0.00
	Constant & trend	0.00	0.00	0.51	0.00
	None	0.00	0.00	0.45	0.00
Korea	Constant	0.00	0.00	0.11	0.00
	Constant & trend	0.00	0.00	0.24	0.00
	None	0.00	0.00	0.23	0.00
Philippines	Constant	0.00	0.00	0.12	0.00
	Constant & trend	0.00	0.00	0.12	0.00
	None	0.00	0.00	0.34	0.00
Thailand	Constant	0.00	0.00	0.03	0.00
	Constant & trend	0.00	0.00	0.09	0.00
	None	0.00	0.00	0.01	0.00

Table 2
Optimal Lag Lengths based
on the Akaike Information Criterion

	Indonesia	Korea	Philippines	Thailand
First sub-period (87:01-97:06)	2	2	2	6
Second sub-period (97:07-02:07)	7	5	1	8

Table 3
Pairwise Granger Causality Tests
Indonesia

Pairwise Granger Causality Tests
Sample: 1987:01 1997:06
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_I does not Granger Cause EMP_I	85	1.09929	0.36315
EMP_I does not Granger Cause DELTA_I		2.85021	0.02940
D(PHI_I) does not Granger Cause EMP_I	85	3.13390	0.01929
EMP_I does not Granger Cause D(PHI_I)		2.28160	0.06821
D(PHI_I) does not Granger Cause DELTA_I	85	2.11107	0.08760
DELTA_I does not Granger Cause D(PHI_I)		2.32959	0.06355

Pairwise Granger Causality Tests
Sample: 1997:07 2001:07
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_I does not Granger Cause EMP_I	49	2.01451	0.11084
EMP_I does not Granger Cause DELTA_I		2.17280	0.08956
D(PHI_I) does not Granger Cause EMP_I	49	0.61338	0.65546
EMP_I does not Granger Cause D(PHI_I)		0.74155	0.56934
D(PHI_I) does not Granger Cause DELTA_I	49	0.60194	0.66343
DELTA_I does not Granger Cause D(PHI_I)		0.72705	0.57874

Table 3 (continued)
Pairwise Granger Causality Tests
Korea

Pairwise Granger Causality Tests
Sample: 1987:01 1997:06
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_K does not Granger Cause EMP_K	122	3.02549	0.02061
EMP_K does not Granger Cause DELTA_K		1.89703	0.11581
D(PHI_K) does not Granger Cause EMP_K	121	0.16508	0.95566
EMP_K does not Granger Cause D(PHI_K)		0.86156	0.48947
D(PHI_K) does not Granger Cause DELTA_K	121	1.22546	0.30410
DELTA_K does not Granger Cause D(PHI_K)		0.09168	0.98491

Pairwise Granger Causality Tests
Sample: 1997:07 2001:07
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_K does not Granger Cause EMP_K	49	2.17249	0.08959
EMP_K does not Granger Cause DELTA_K		2.06252	0.10390
D(PHI_K) does not Granger Cause EMP_K	49	1.15900	0.34329
EMP_K does not Granger Cause D(PHI_K)		4.56213	0.00395
D(PHI_K) does not Granger Cause DELTA_K	49	5.35581	0.00150
DELTA_K does not Granger Cause D(PHI_K)		3.07137	0.02688

Table 3 (continued)
Pairwise Granger Causality Tests
Philippines

Pairwise Granger Causality Tests
Sample: 1987:01 1997:06
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_P does not Granger Cause EMP_P	122	0.60835	0.65744
EMP_P does not Granger Cause DELTA_P		4.22238	0.00319
D(PHI_P) does not Granger Cause EMP_P	121	2.36511	0.05717
EMP_P does not Granger Cause D(PHI_P)		5.60688	0.00038
D(PHI_P) does not Granger Cause DELTA_P	121	0.70451	0.59048
DELTA_P does not Granger Cause D(PHI_P)		2.61127	0.03919

Pairwise Granger Causality Tests
Sample: 1997:07 2001:07
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_P does not Granger Cause EMP_P	49	2.24430	0.08133
EMP_P does not Granger Cause DELTA_P		1.40906	0.24851
D(PHI_P) does not Granger Cause EMP_P	49	1.35066	0.26821
EMP_P does not Granger Cause D(PHI_P)		2.86761	0.03524
D(PHI_P) does not Granger Cause DELTA_P	49	1.57261	0.20029
DELTA_P does not Granger Cause D(PHI_P)		1.82605	0.14280

Table 3 (continued)
Pairwise Granger Causality Tests
Thailand

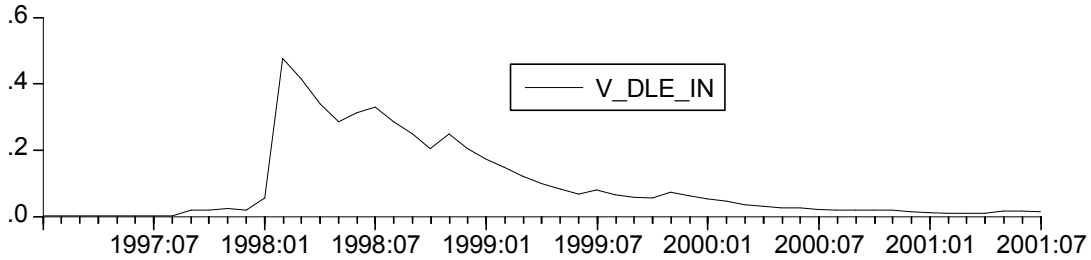
Pairwise Granger Causality Tests
Sample: 1987:01 1997:06
Lags: 4

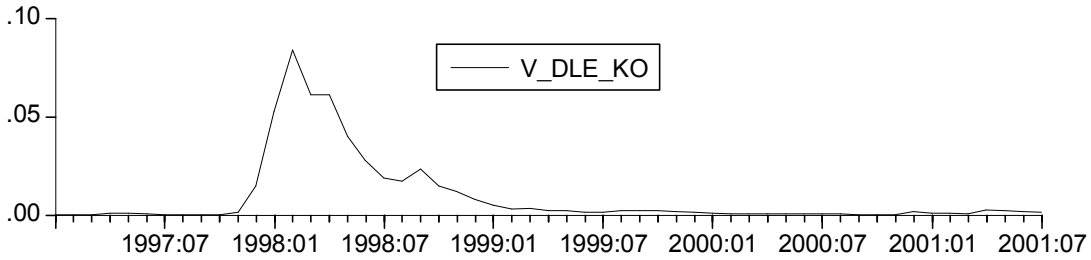
Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_T does not Granger Cause EMP_T	122	1.31329	0.26934
EMP_T does not Granger Cause DELTA_T		7.60157	1.8E-05
D(PHI_T) does not Granger Cause EMP_T	121	2.39947	0.05425
EMP_T does not Granger Cause D(PHI_T)		6.52060	9.4E-05
D(PHI_T) does not Granger Cause DELTA_T	121	1.63978	0.16921
DELTA_T does not Granger Cause D(PHI_T)		2.45342	0.04995

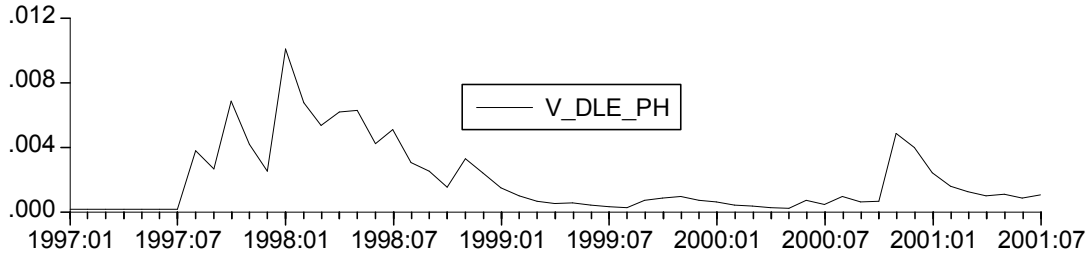
Pairwise Granger Causality Tests
Sample: 1997:07 2001:07
Lags: 4

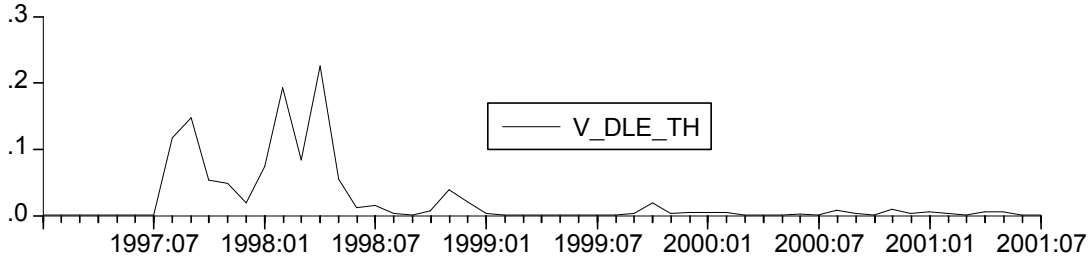
Null Hypothesis:	Obs	F-Statistic	Probability
DELTA_T does not Granger Cause EMP_T	49	2.14486	0.09299
EMP_T does not Granger Cause DELTA_T		2.59476	0.05076
D(PHI_T) does not Granger Cause EMP_T	49	1.49009	0.22339
EMP_T does not Granger Cause D(PHI_T)		2.05216	0.10536
D(PHI_T) does not Granger Cause DELTA_T	49	1.73260	0.16184
DELTA_T does not Granger Cause D(PHI_T)		0.75914	0.55805

Figure 1*
Conditional Variance – Currency Depreciation (1997 – 2001)



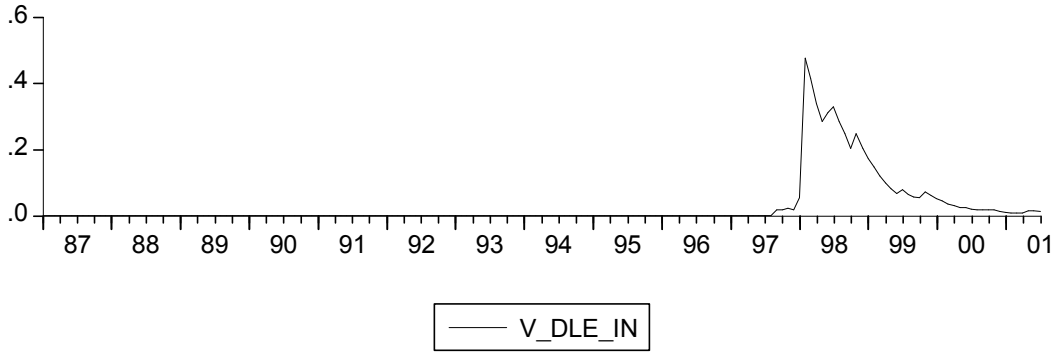


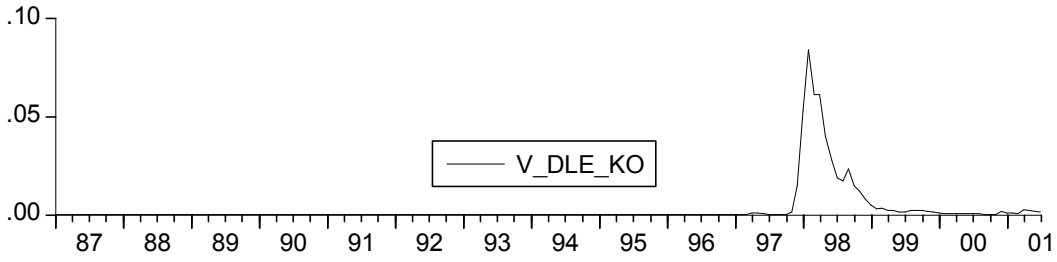


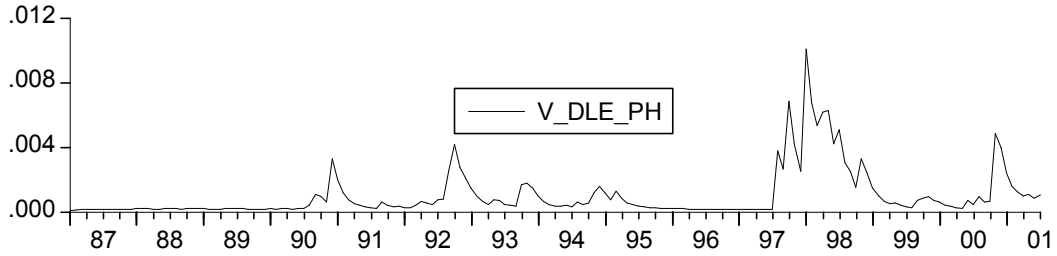


*For all figures, the prefixes indicate the countries; IN= Indonesia, KO=Korea, PH=Philippines, and TH=Thailand.

Figure 1 (continued)
Conditional Variance – Currency Depreciation (1987 – 2001)







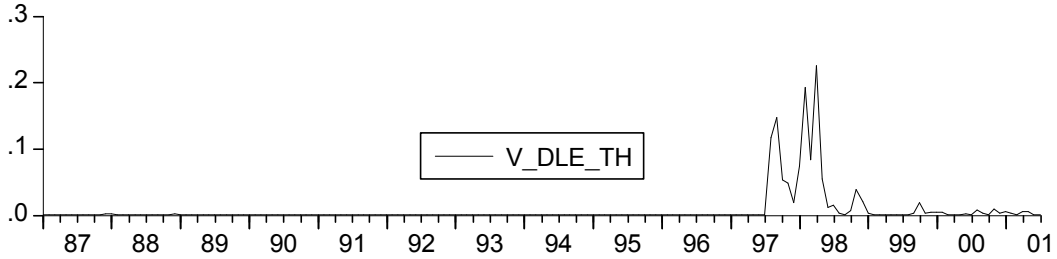


Figure 2
Conditional variance – Percent change in interest rate (1997 – 2001)

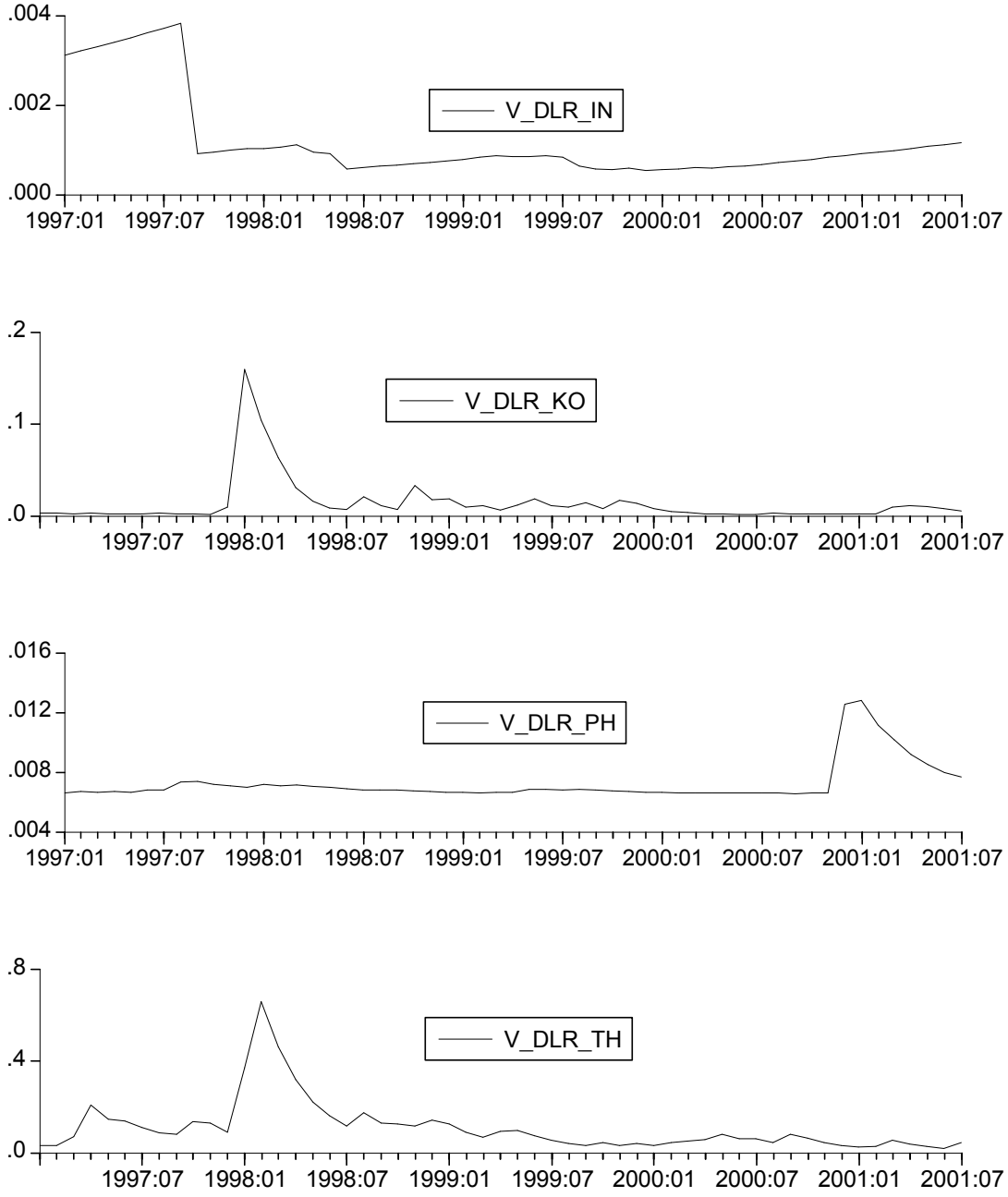


Figure 2 (continued)
Conditional variance – Percent change in interest rate (1987 – 2001)

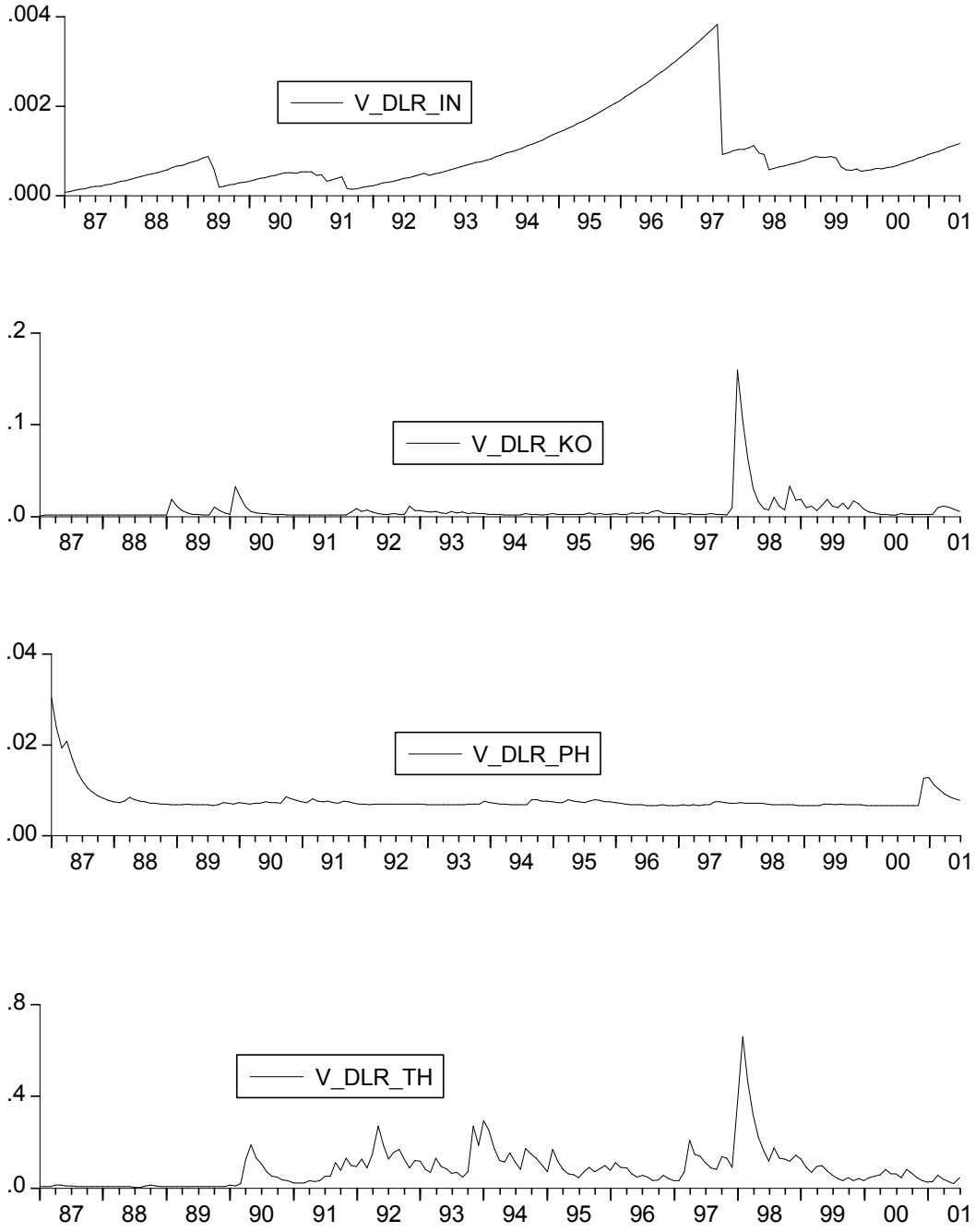


Figure 3
Conditional variance – international reserve growth (1997-2001)

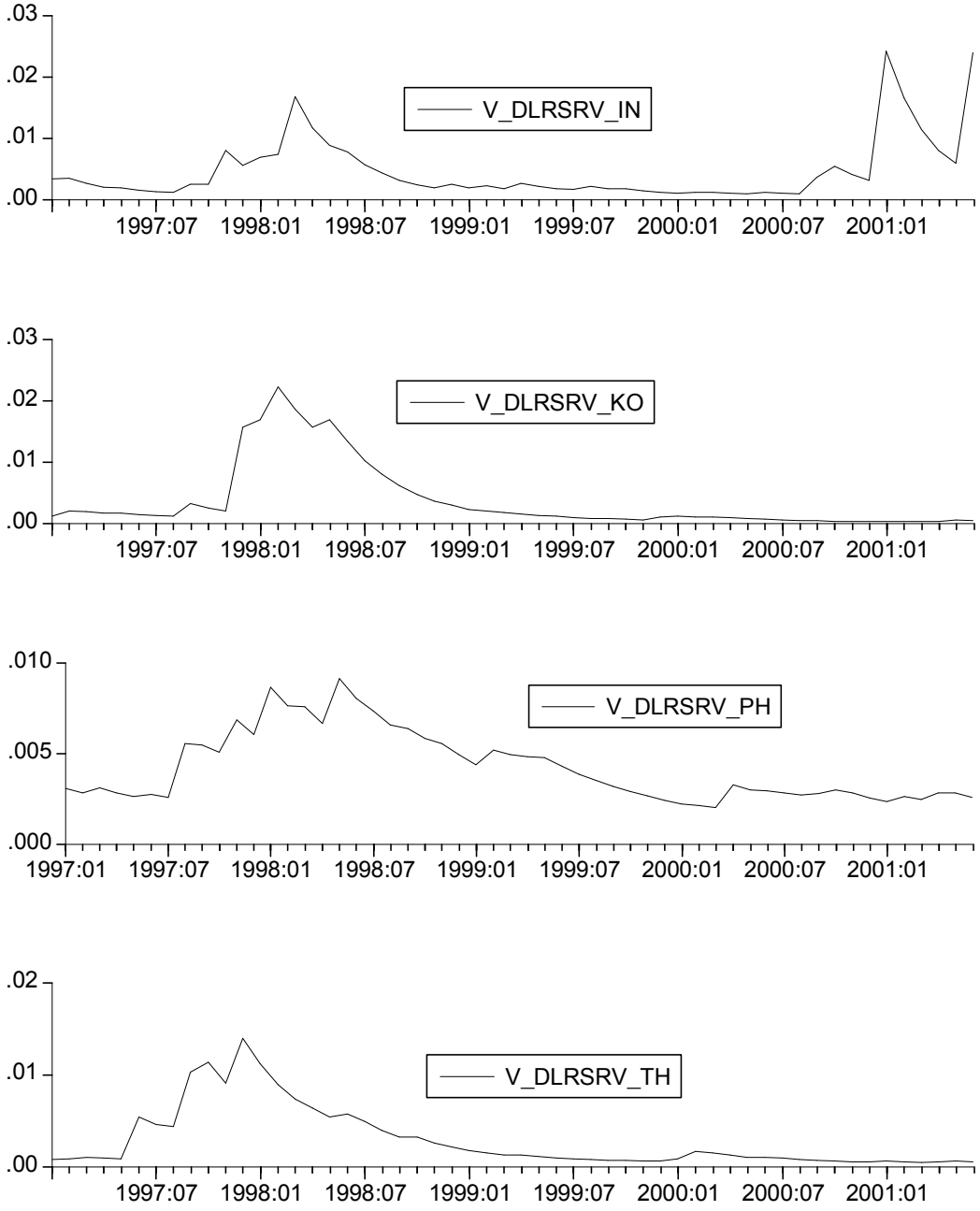
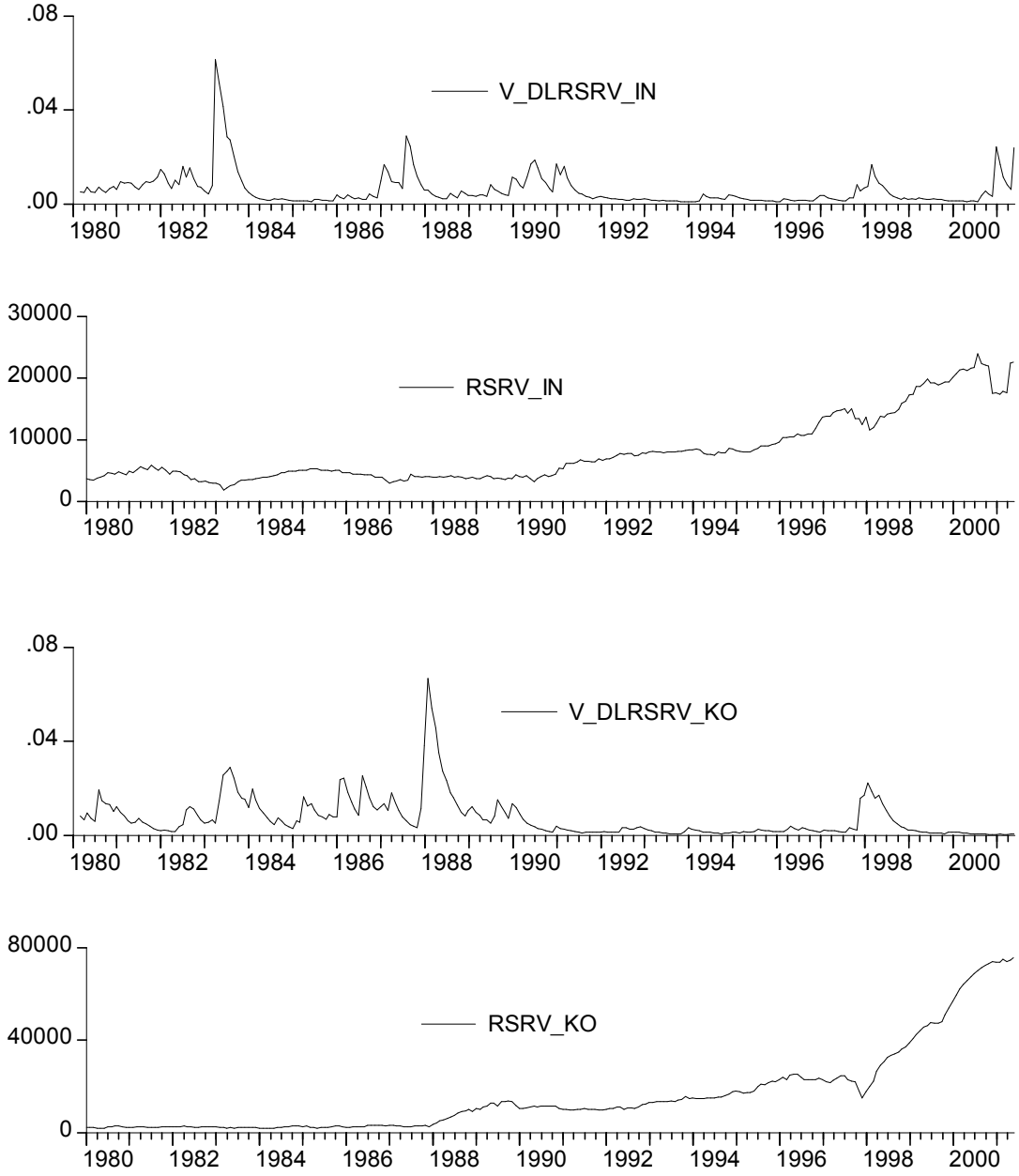


Figure 4
Conditional Variance of Growth Rate of International Reserves and the Level of Reserves
(1987-2001)



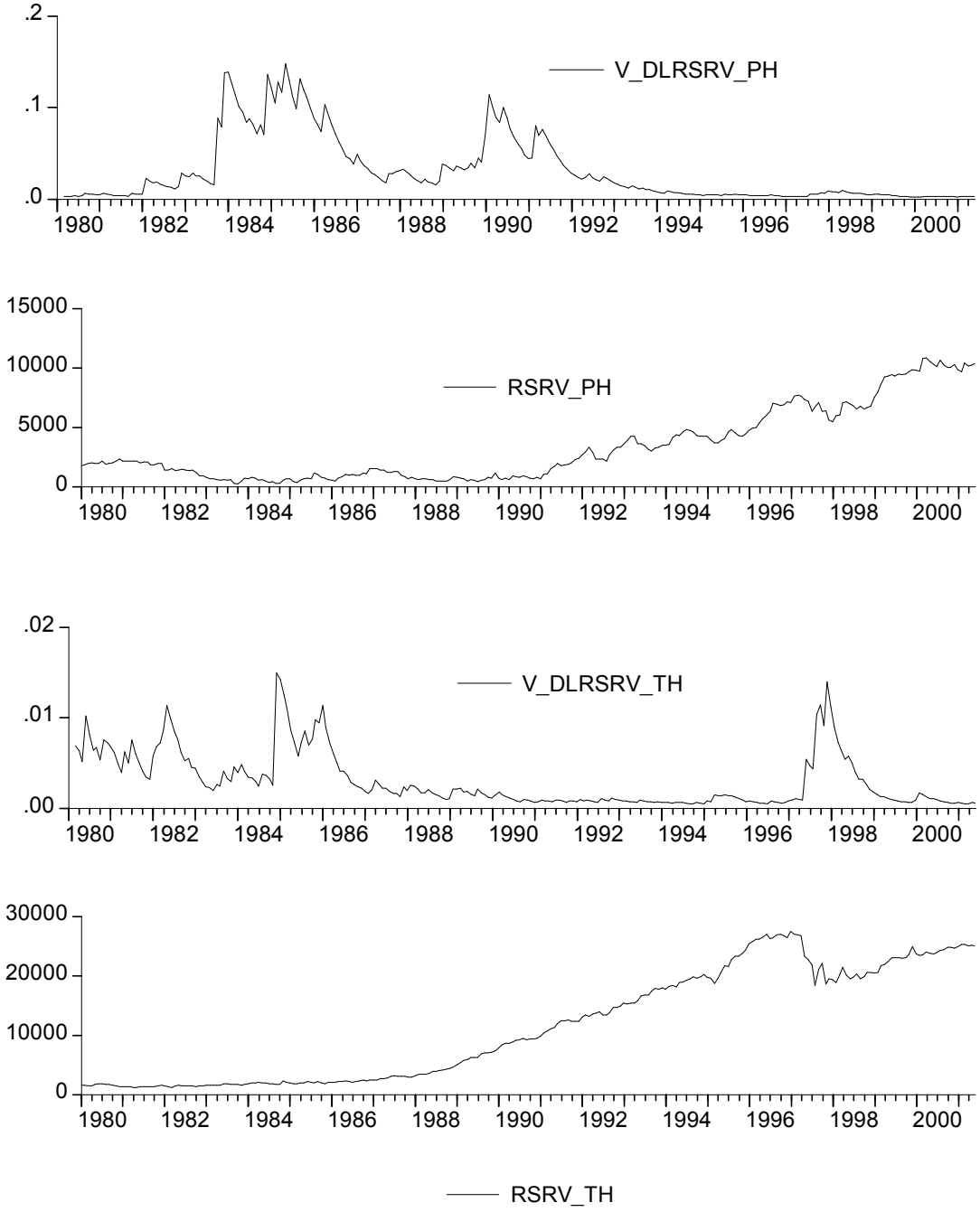

.2
.1
.0
V_DLRSRV_PH
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
15000
10000
5000
0
RSRV_PH
.02
.01
.00
V_DLRSRV_TH
30000
20000
10000
0
RSRV_TH

Figure 5
Currency Depreciation Volatility/Interest Rate Volatility (1997-2001)

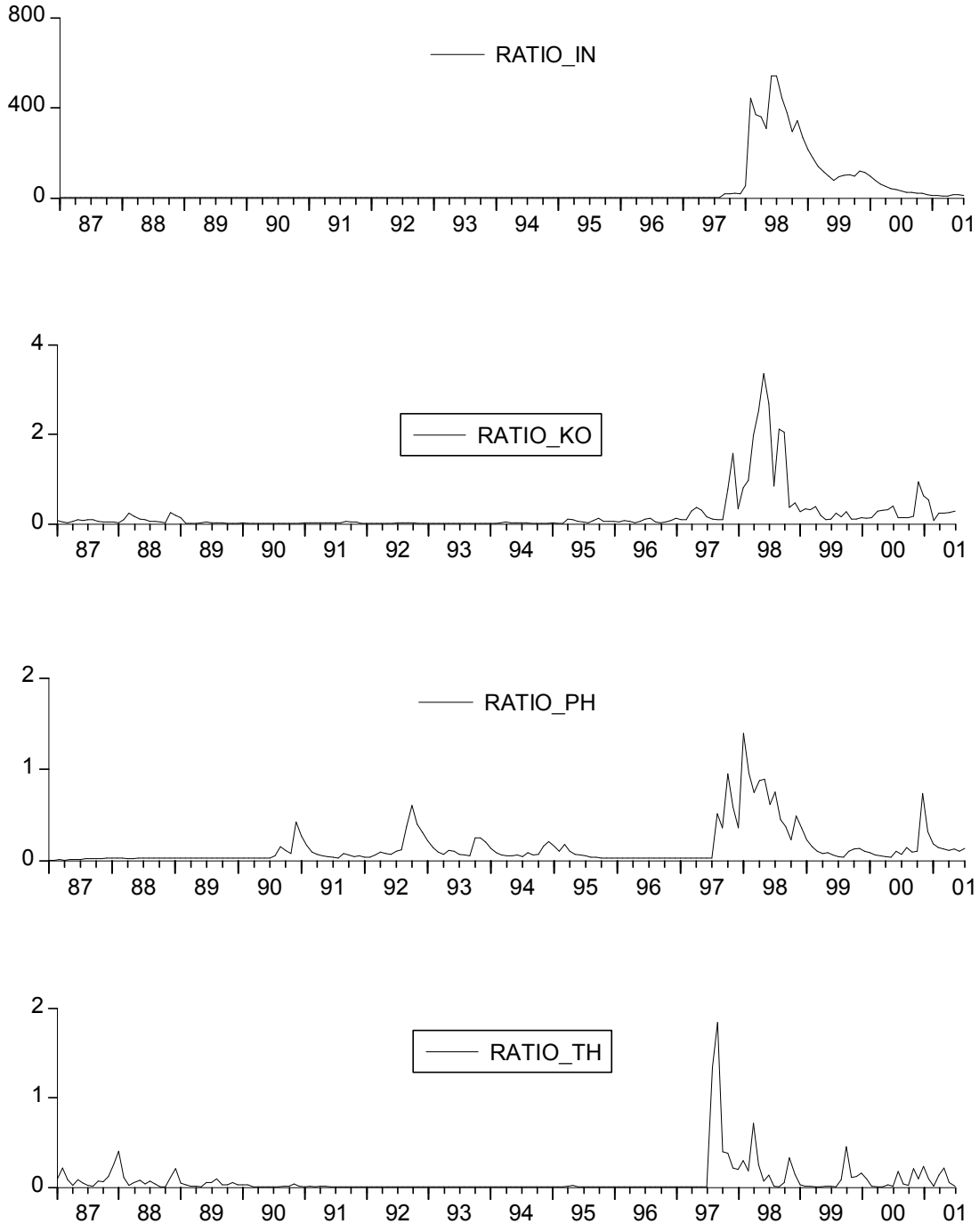


Figure 6
Currency Depreciation Volatility/International Reserve Volatility (1997-2001)

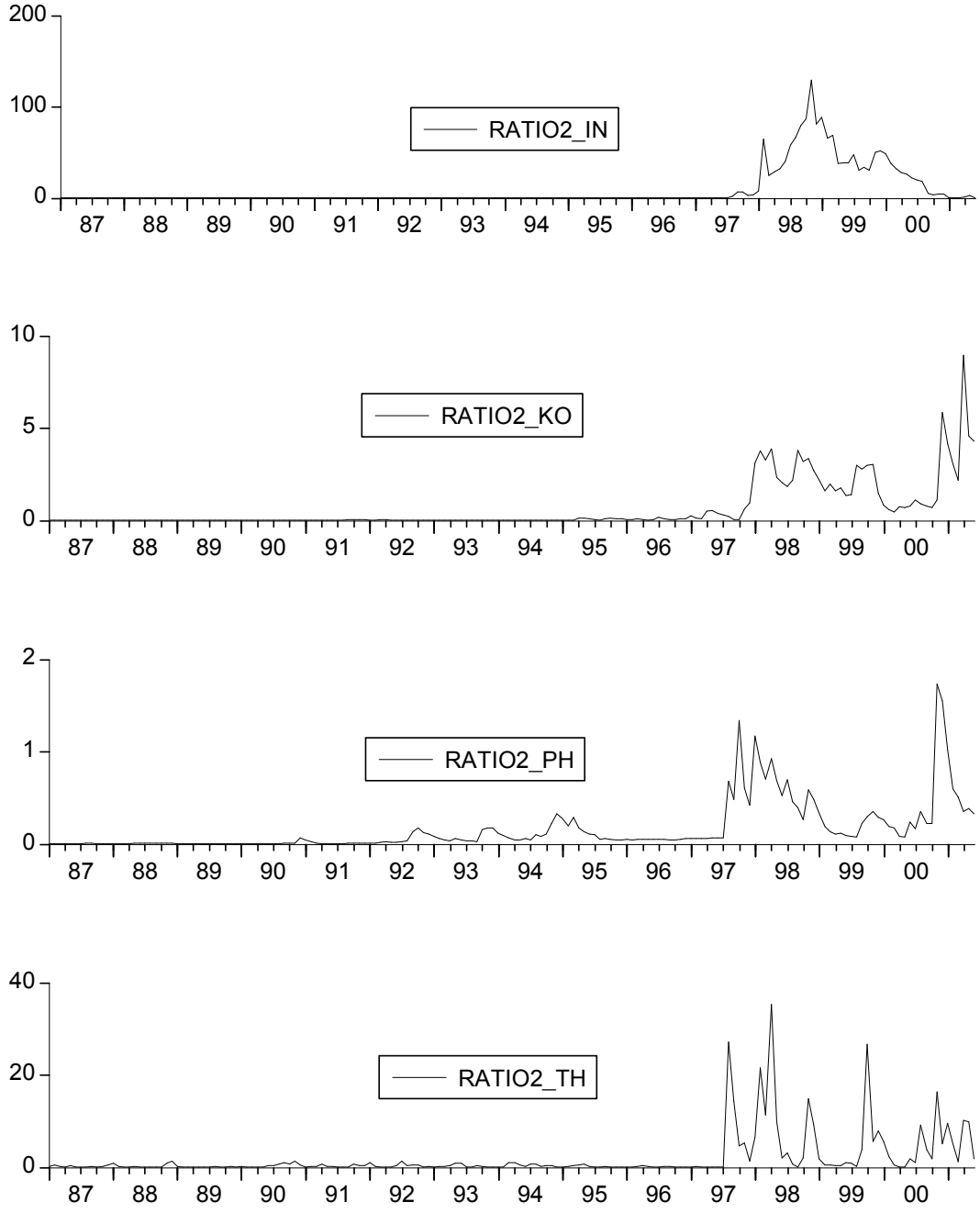


Figure 7A
Indonesia, First sub-period (87:01-1997:06), 2 lags

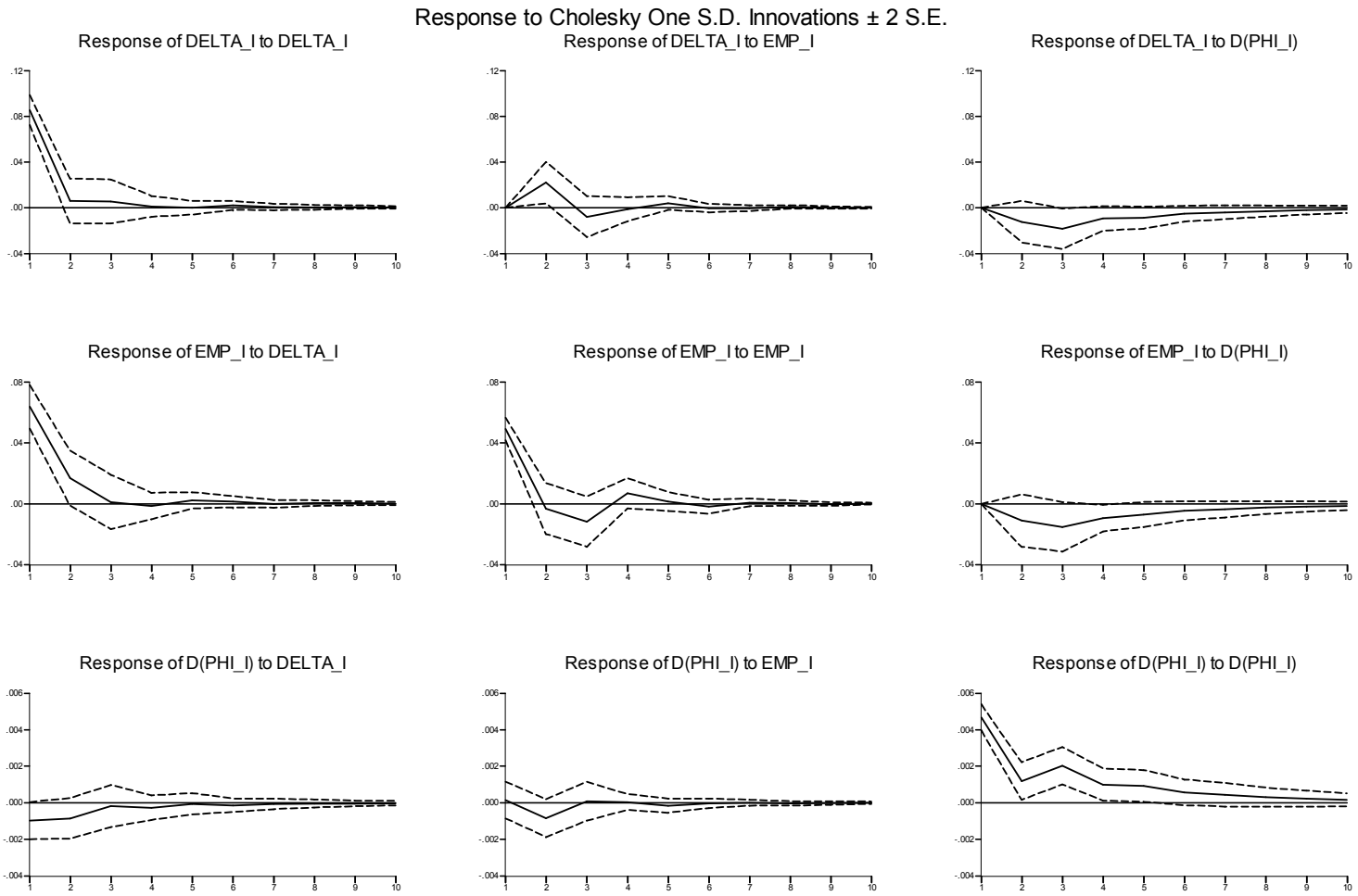


Figure 7B
Korea, First sub-period (87:01-1997:06), 2 lags

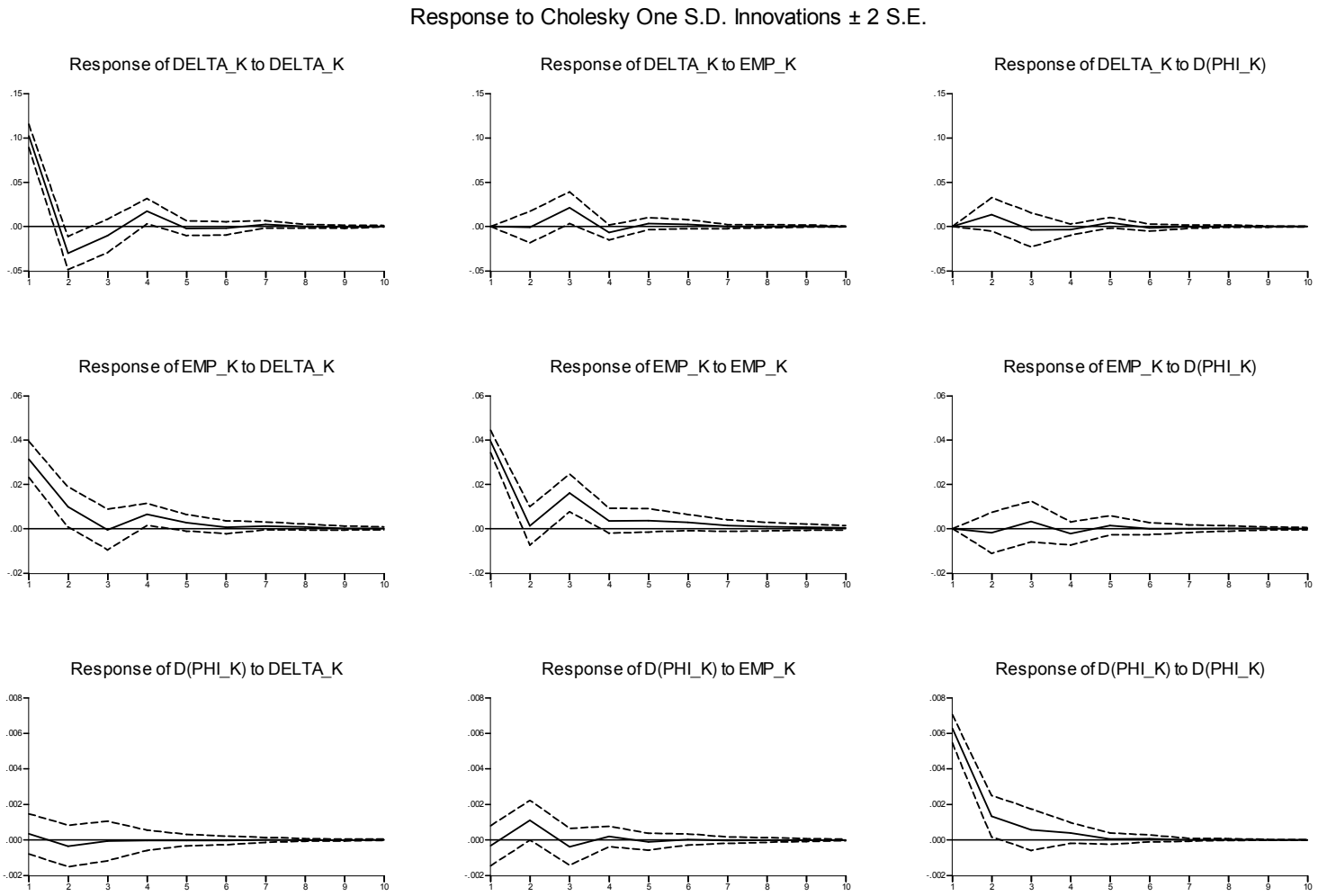


Figure 7C
Philippines, First sub-period (87:01-1997:06), 2 lags

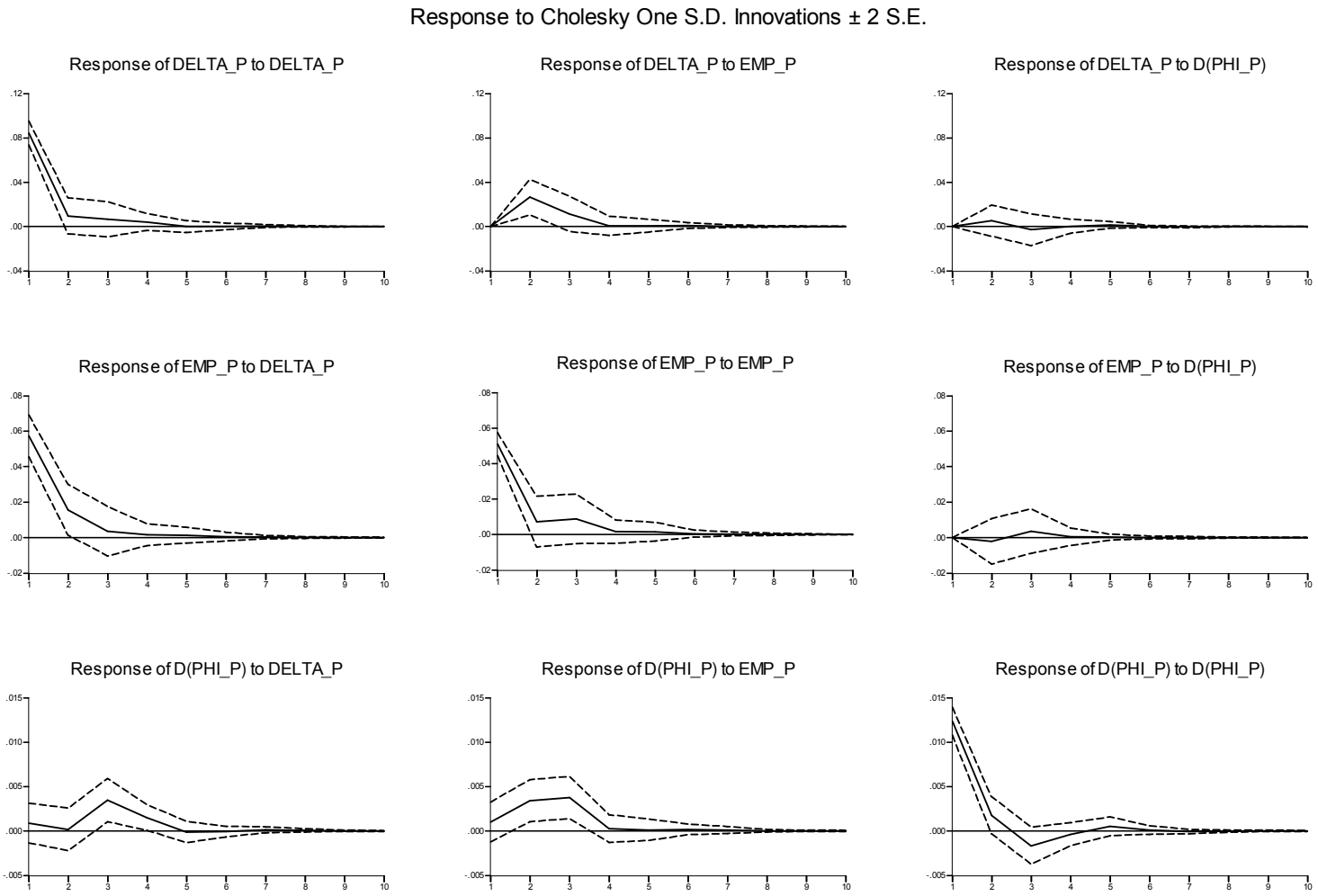


Figure 7D
Thailand, First sub-period (87:01-1997:06), 6 lags

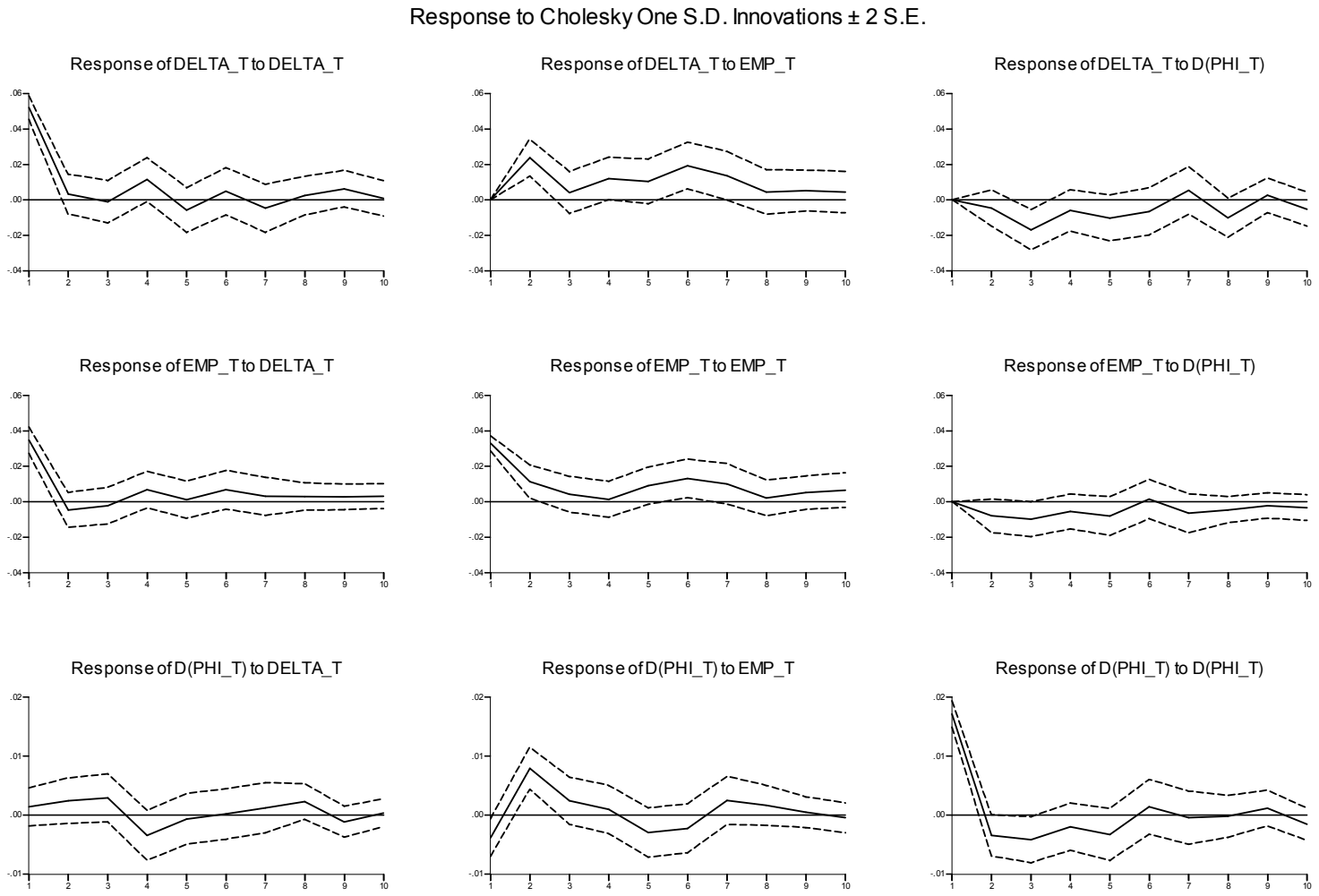


Figure 8A
Indonesia, Second sub-period (1997:07-2002:07), 7 lags

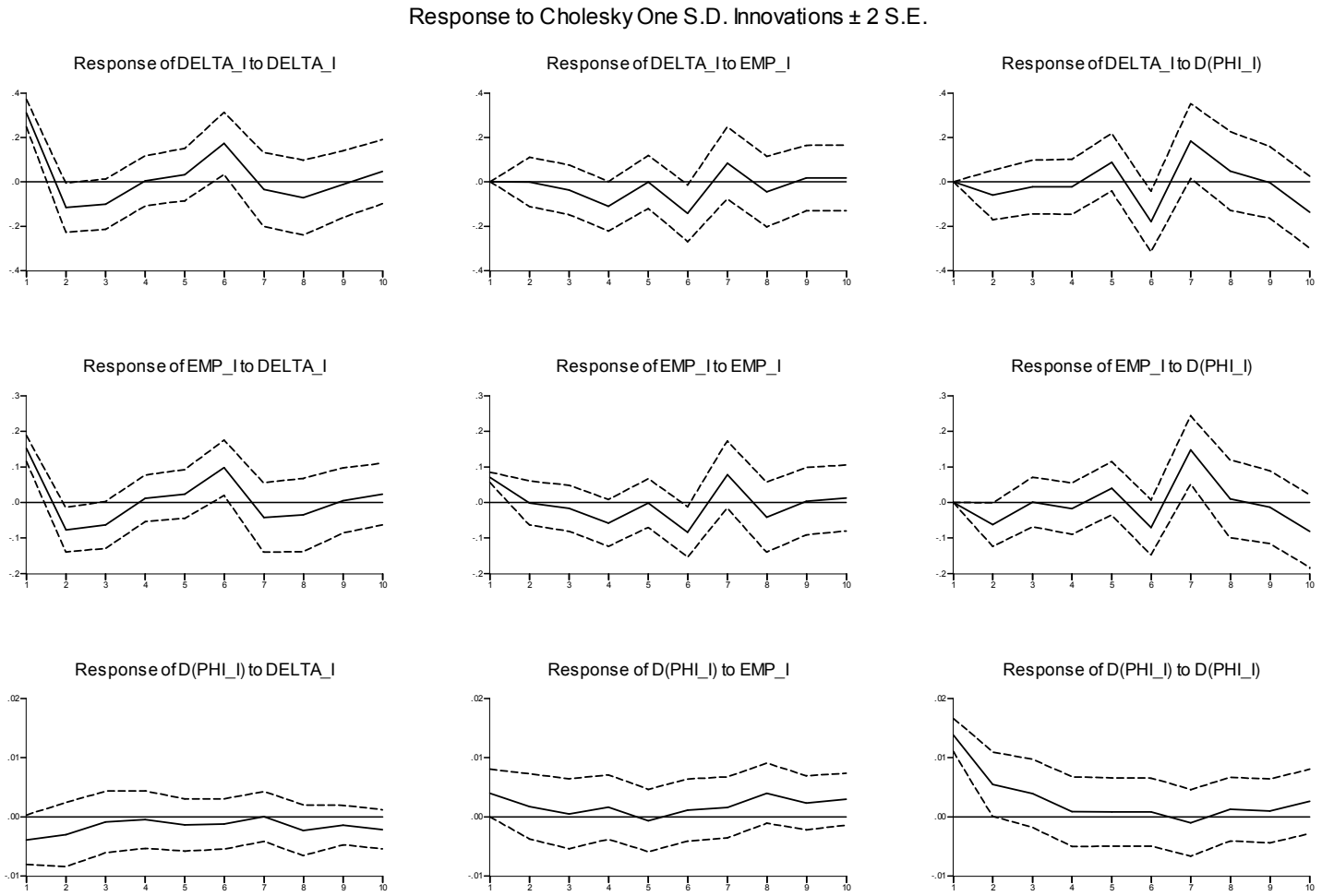


Figure 8B
Korea, Second sub-period (1997:07-2002:07), 5 lags

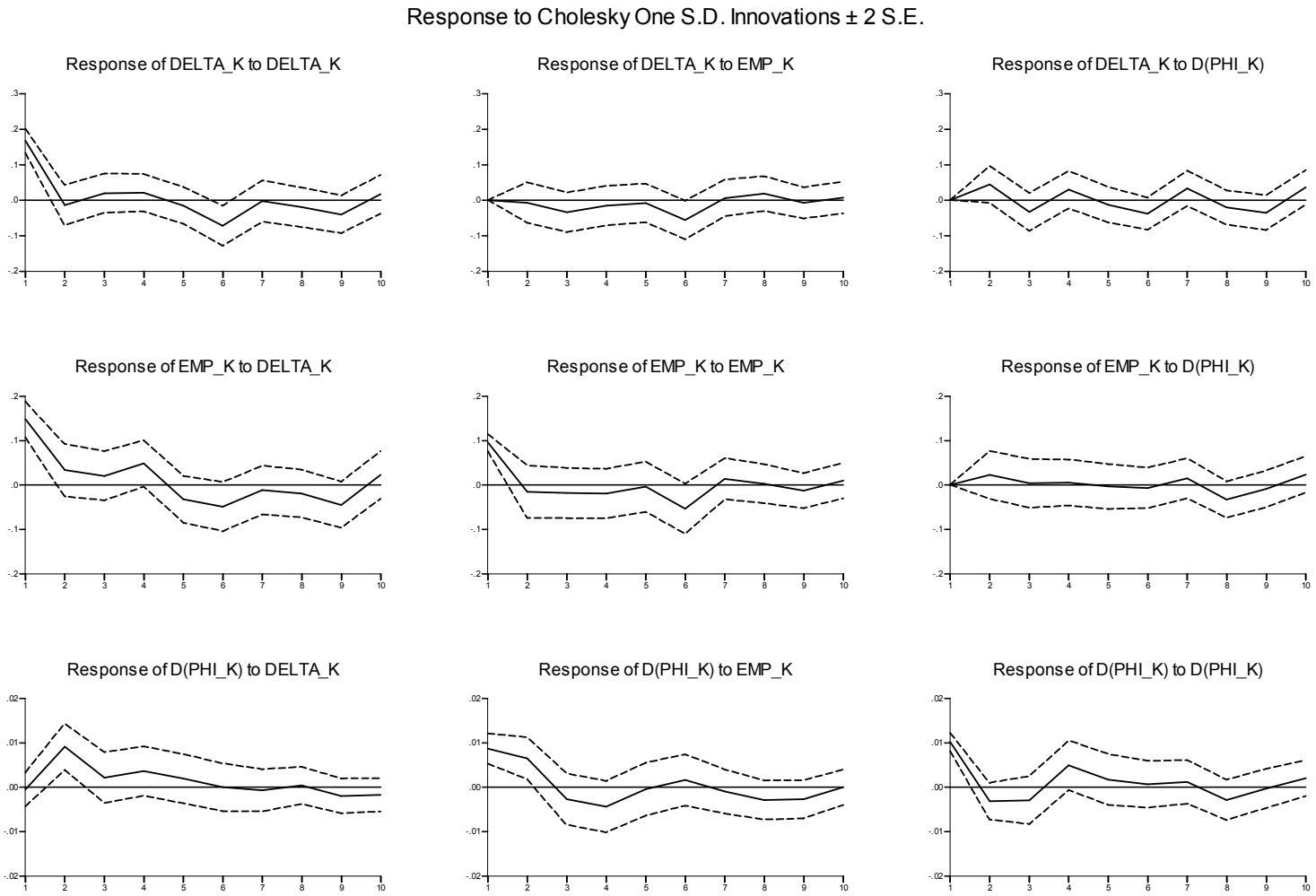


Figure 8C
Philippines, Second sub-period (1997:07-2002:07), 1 lag

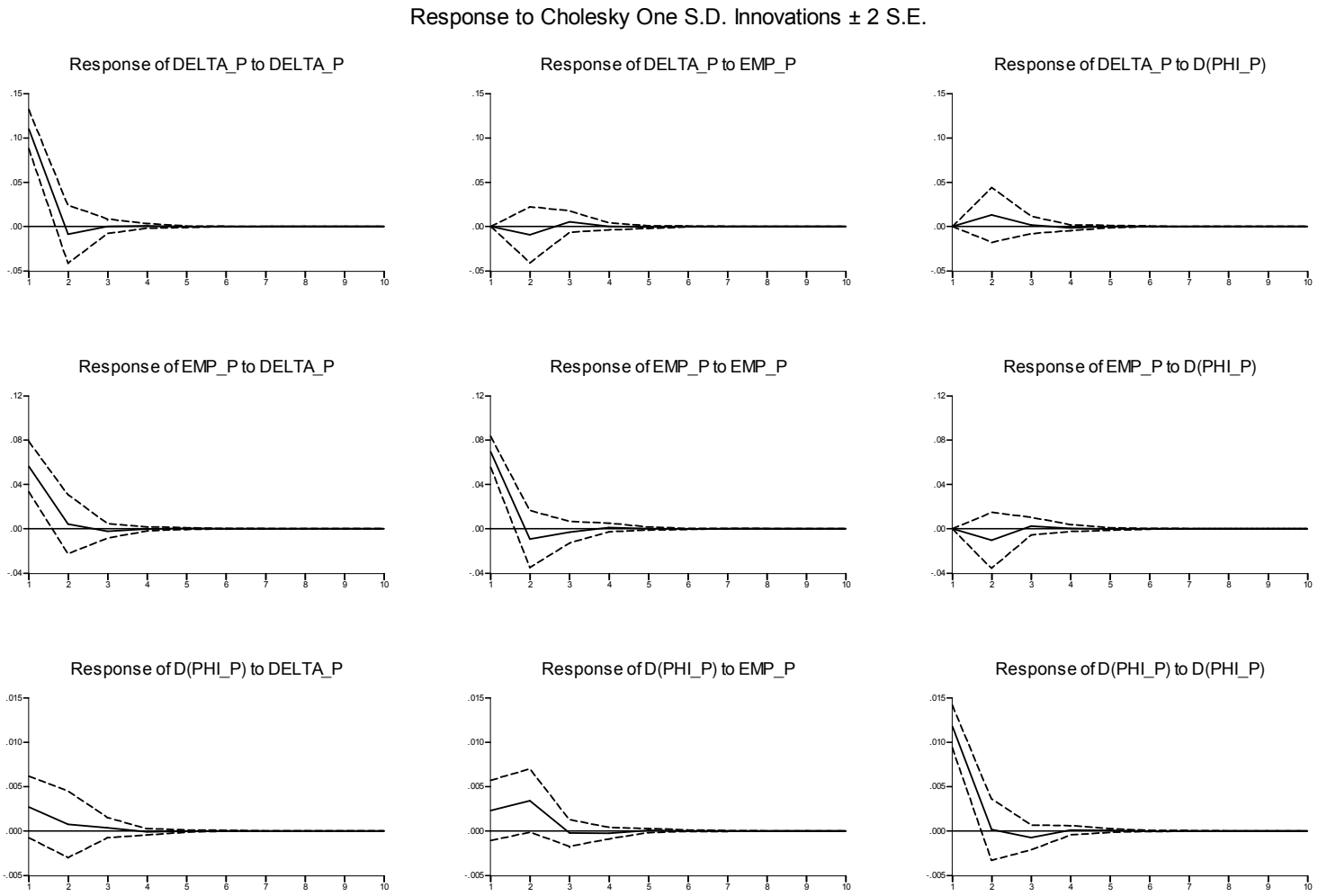
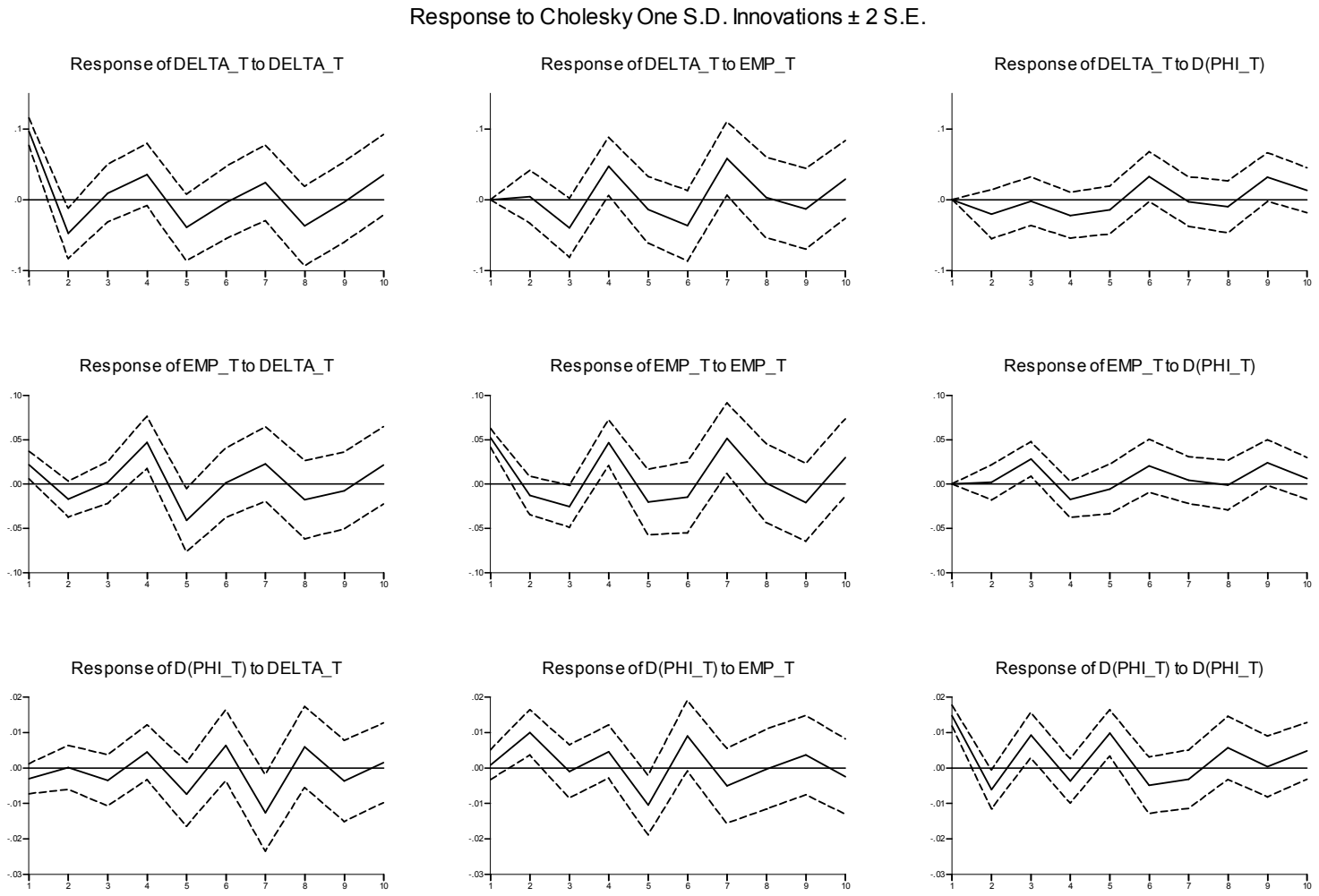


Figure 8D
Thailand, Second sub-period (1997:07-2002:07), 8 lags



[i] As suggested by a referee, the VAR was run with either domestic credit creation or interest rate differential alone instead of both as in the study. The results regarding the effect of a shock to domestic credit creation on EMP for both periods are unaffected when only domestic credit creation is used in the VAR. The magnitude of the response in Indonesia is much larger than that for the other countries. When the interest rate differential is used alone with EMP, Indonesia's and Thailand's IRFs show a negative response of EMP to a shock in the interest rate differential in the non-crisis period while those for the Philippines and Korea show that the magnitude is practically zero. In the crisis period, Indonesia's IRF again shows a negative relationship initially but in general, for all countries, the magnitude of the effect of a shock to the interest rates differential on EMP is practically zero. These results are available from the authors upon request.

[ii] The results using domestic credit creation alone in the VAR as far as the effect of EMP on domestic credit creation is concerned are essentially unchanged from those in the study. In the second sub-period, the effect of a shock to EMP on domestic credit creation for the Philippines is practically zero.

[iii]When the interest rate differential is used alone with EMP in the VAR, the Philippines and Thailand had a lagged positive response in the interest rate differential from a shock to EMP in the first period. In the crisis period, Korea and the Philippines had lagged positive responses while Indonesia had lagged negative responses and Thailand had more mixed results.